PROCEEDINGS

OF THE

BOARD OF AGRICULTURE IN INDIA

HELD AT

No. 25931
MAY 1932

NAGPUR

ON THE

15th February 1909, and following days

WITH APPENDICES

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No. C-1420, dated Camp Poona, the 15th March 1909.

From—J. MOLLISON, Esq., M.R.A.C., Inspector General of Agriculture in India,

To—The Secretary to the Government of India, Department of Revenue and Agriculture.

I have the honour to submit the Proceedings of the Fifth Meeting of the Board of Agriculture in India, held at Nagpur on the 15th February 1909, and subsequent days. These Proceedings have been recorded by Mr. F. M. Howlett, Second Imperial Entomologist, who agreed to act as Secretary. The Proceedings have been approved by the Board.

2. The Note on Extension of Cultivation of Fibre Plants in India, which forms Appendix B to the Proceedings, is being revised by Messrs. Burkill, Gammie and Finlow and will be submitted when received.

Proceedings of the Fifth Annual Meeting of the Board of Agriculture in India, held at Nagpur on the 15th February 1909, and succeeding days.

LIST OF MEMBERS.

1. J. MOLLISON, M.R.A.C., *Inspector General of Agriculture in India (President of the Board).*
2. F. M. HOWLETT, B.A., F.E.S., *Second Imperial Entomologist, Secretary to the Board.*
3. B. COVENTRY, *Director, Agricultural Research Institute, and Principal of the Agricultural College, Pusa.*
4. J. W. LEATHER, Ph.D., F.I.C., F.C.S., *Imperial Agricultural Chemist, Pusa.*
5. E. J. BUTLER, M.B., F.L.S., *Imperial Mycologist, Pusa.*
6. C. J. BERGTHEIL, *Imperial Bacteriologist, Pusa.*
7. E. SHEARER, M.A., B.Sc., *Imperial Agriculturist, Pusa.*
8. A. HOWARD, M.A., A.R.C.S., F.C.S., F.L.S., *Imperial Economic Botanist, Pusa.*
9. G. A. GAMMIE, F.L.S., *Imperial Cotton Specialist, Poona.*
10. FRED. NOËL-PATON, *Director General of Commercial Intelligence.*
11. I. H. BURKILL, M.A., *Reporter on Economic Products to the Government of India.*
12. W. R. GOURLAY, I.C.S., *Director of Agriculture, Bengal.*
13. F. SMITH, B.Sc., *Deputy Director of Agriculture, Bengal.*
14. E. J. WOODHOUSE, B.A., *Economic Botanist, Bengal.*
15. W. H. MORELAND, B.A., LL.B., C.I.E., I.C.S., *Director of Agriculture, United Provinces of Agra and Oudh.*
16. B. C. BURT, B.Sc., F.C.S., *Deputy Director of Agriculture, United Provinces of Agra and Oudh.*
17. A. E. PARR, M.A., B.Sc., Ph.D., M.S., *Deputy Director of Agriculture, United Provinces of Agra and Oudh.*
18. W. C. RENOUF, I.C.S., *Director of Agriculture, Punjab.*
19. J. H. BARNES, B.Sc., A.I.C., F.C.S., R.I.P.H., *Agricultural Chemist and Principal of the Agricultural College, Punjab.*
20. S. MILLIGAN, M.A., B.Sc., *Deputy Director of Agriculture, Punjab.*
21. G. F. KEATINGE, I.C.S., *Director of Agriculture, Bombay.*
22. H. H. MANN, D.Sc., *Agricultural Chemist and Principal, Agricultural College, Bombay Presidency, Poona.*

23. J. B. KNIGHT, M.Sc., *Professor of Agriculture, Agricultural College, Poona.*

24. M. E. COUCHMAN, I.C.S., *Director of Agriculture, Madras.*

25. H. C. SAMPSON, B.Sc., F.H.A.S., F.B.S.E., *Deputy Director of Agriculture, Madras.*

26. P. HEMINGWAY, I.C.S., *Director of Agriculture, Central Provinces and Berar.*

27. D. CLOUSTON, M.A., B.Sc., *Deputy Director of Agriculture, Central Provinces, Nagpur (South Circle).*

28. G. EVANS, B.A., *Deputy Director of Agriculture, Central Provinces, Hoshangabad (North Circle).*

29. S. G. HART, I.C.S., *Director of Agriculture, Eastern Bengal and Assam.*

30. A. G. BIRT, B.Sc., *Officiating Assistant Director of Agriculture, Eastern Bengal and Assam.*

31. R. S. FINLOW, B.Sc., F.C.S., *Fibre Expert to the Government of Eastern Bengal and Assam.*

32. J. MACKENNA, M.A., I.C.S., *Director of Agriculture, Burma.*

33. E. THOMPSTONE, B.Sc., *Principal, Agricultural College, Burma.*

34. L. C. COLEMAN, Ph.D., *Mycologist and Entomologist to the Government of Mysore.*

35. M. A. SITOLE, B.A., M.R.A.C., *Bar.-at-Law, Director of Agriculture and Industries, Baroda.*

36. L. C. SHARMA, M.R.A.C., P.A.S.I., *Bar.-at-Law, Director of Agriculture, Kashmir.*

VISITORS.

37. CAPTAIN F. S. H. BALDREY, F.R.C.V.S., *Superintendent, Civil Veterinary Department, Central Provinces and Berar.*

38. W. MCRAE, M.A., B.Sc., *Supernumerary Mycologist, Pusa.*

39. F. J. PLYMEN, A.C.G.I., *Agricultural Chemist, Central Provinces and Berar.*

40. R. G. ALLAN, M.A., B.Sc., *Principal, Agricultural College, Nagpur.*

41. R. J. D. GRAHAM, M.A., B.Sc., *Economic Botanist, Central Provinces and Berar.*

42. VISHNU DUTTA SUKULA, B.A., *Jubbulpore.*

43. M. LONSDALE, N.D.A., N.D.D., *Agricultural Expert, for Court of Wards, Madras.*

44. J. E. LESLIE, *Superintendent, Horticultural Gardens, Nagpur.*

Programme of the Fifth Meeting of the Board of Agriculture in India, 1909.

SUBJECT I.—THE CONFIRMATION OF THE PROCEEDINGS OF THE LAST MEETING.

SUBJECT II.—THE PROGRAMME OF WORK OF THE IMPERIAL DEPARTMENT OF AGRICULTURE.

A consideration of the programmes of—

(1) The Director, Agricultural Research Institute, Pusa ;
(2) The Imperial Agricultural Chemist ;
(3) The Imperial Mycologist ;
(4) The Imperial Entomologist ;
(5) The Second Imperial Entomologist ;
(6) The Imperial Economic Botanist ;
(7) The Imperial Agriculturist ;
(8) The Imperial Bacteriologist ; and
(9) The Imperial Cotton Specialist.

2. Provincial Directors of Agriculture should examine them to see whether they meet the requirements of their own Provinces; Imperial Experts should examine them to see whether the programmes of branches, other than their own, meet their requirements.

SUBJECT III.—The Programmes of Work of the Provincial and Native States Departments of Agriculture.

A consideration of the programmes submitted by—

(a) Bengal.
(b) The United Provinces.
(c) The Punjab.
(d) Bombay.
(e) Madras.
(f) The Central Provinces and Berar.
(g) Eastern Bengal and Assam.
(h) Burma.
(i) Mysore State.
(j) Baroda State.
(k) Kashmir State.

2. The Imperial Experts should consider whether the programmes meet their requirements and whether they can suggest improvements. The Provincial Directors of Agriculture should consider whether the programmes of other Provinces can be so improved as to meet any special requirement of their Provinces or to co-ordinate the work.

SUBJECT IV.—The Best Means of bringing the Results of Experimental Work in Agriculture to the Notice of Cultivators.

A continuation of the discussion at last year's meeting of the Board, as to the best lines for future work.

2. Provincial Directors of Agriculture should furnish details of such methods as have been adopted in the different Provinces during the last year, but have not been included in the amplified report of the Committee, copies of which are supplied by the Inspector General of Agriculture.

SUBJECT V.—Touring of Agricultural Experts outside their own Provinces.

A discussion regarding the necessity of the Experts in each Province being allowed to tour in other Provinces in order to gain a complete knowledge regarding investigations already made in India in which they are specially interested.

SUBJECT VI.—Agricultural Education.

A discussion (a) as to the progress made and the difficulties experienced in giving agricultural education in India; (b) regarding the course of instruction at Pusa as explained in the provisional prospectus recently issued, with special reference to the following points:—(1) whether the syllabus sufficiently emphasizes the function of the Pusa College as a higher teaching institution intended for students who have already passed through the course of a Provincial College, (2) whether it makes sufficient provision for research, and (3) whether the course provided in agriculture is adequate; (c) as to the need of a permanent Committee to give year by year general advice to the Board as regards (a) and (b).

SUBJECT VII.—Introduction of good indigenous methods of Cultivation, Implements and Crops.

A discussion as to the best means of transferring them from district to district or from province to province.

SUBJECT VIII.—AGRICULTURAL STATIONS, DEMONSTRATION AREAS AND SEED FARMS.

A discussion regarding agricultural stations, demonstration areas and seed farms, particularly as regards their size and equipment.

SUBJECT IX.—TRAINING OF INDIAN OFFICERS FOR THE MANAGEMENT OF AGRICULTURAL STATIONS.

A discussion as to the best means of training them for this work.

SUBJECT X.—DISSEMINATION OF THE WORK AND AIMS OF THE AGRICULTURAL DEPARTMENT THROUGH THE PRESS.

A discussion as to the relation of the Agricultural Department to the Press, and how more advertisement of the work done by it can be secured.

APPOINTMENT OF COMMITTEES.

1. The President, after welcoming the members of the Board, referred to the help and hospitality which had been so freely given by Mr. Hemingway and other officers at Nagpur. Dr. Butler was the recipient of a hearty vote of thanks for the excellent way in which he had discharged the duties of Honorary Secretary during the last four meetings of the Board. The President then laid before the Meeting a draft of the constitution and terms of reference of the various Committees proposed in order to consider and report, during the second and third days of the Meeting, on all the subjects before the Board with the exception of Subject No. X, the President deciding that this had better be discussed by a full Meeting.

The Committees were constituted as follows :—

(a) To consider and report on the Programme of work of the Imperial Department of Agriculture.

Committee.—Mr. Moreland (Chairman), Mr. Coventry, Drs. Butler, Mann, Coleman, Messrs. Smith, Milligan, Barnes, Thompstone and Finlow.

Terms of reference.—To consider whether the requirements of all Provinces are sufficiently met by the Pusa Programme of work and, if necessary, to suggest improvements.

(b) To consider and report on the Programme of work of the Provincial and the Native States Departments of Agriculture.

Committee—Mr. Renouf (Chairman), Messrs. Mollison, MacKenna, Couchman, Gourlay, Hart and Noël-Paton, Dr. Leather, Messrs. Shearer and Clouston, Dr. Parr and Mr. Knight.

Terms of reference.—To consider what changes, if any, are desirable particularly in regard to the co-ordination of the work of the Agricultural Department as a whole.

(c) To consider and report on—

(i)—The best means of bringing the results of experimental work in Agriculture to the notice of cultivators.

(ii)—Introduction of good indigenous methods of cultivation, implements and crops.

(iii)—Agricultural Stations, demonstration areas and seed-farms.

Committee.—Dr. Mann (Chairman), Messrs. Mollison, MacKenna, Renouf, Gourlay, Hart, Clouston, Sampson, Burt, Finlow, Smith and Vishnu Dutta Sukula.

Terms of reference—

(a) In regard to subject IV to amplify and revise where necessary the report already submitted on the subject, and to submit the revised report to the Board.

(b) In regard to subject VII to suggest the best means of transference from district to district or from province to province and to submit a concise report.

(c) In regard to subject VIII to discuss and report in a concise form, particularly regarding the size and equipment of the stations.

(d) To consider and report on touring of Agricultural Experts outside their own provinces.

Committee.—Mr. Shearer (Chairman), Messrs. Couchman, Hemingway, Burkill, Gammie, Smith, Captain Baldrey, Messrs. Sitole and Evans.

Terms of reference.—To describe the advantages to be gained and to make definite proposals.

(e) To consider and report on—

(i) Agricultural Education ;

(ii) Training of Indian officers for the management of Agricultural Stations.

Committee.—Mr. Gourlay (Chairman), Messrs. Moreland, Keatinge, Coventry, Drs. Leather, Butler and Mann, Messrs. Sampson, Howard, Clouston, Barnes, Allan, Dr. Coleman, Messrs. Burt and Smith.

Terms of reference.—These are sufficiently explained in the Board's Programme of work.

A report from the Committee is required in each case.

SUBJECT I.—CONFIRMATION OF THE PROCEEDINGS OF THE LAST MEETING.

The minutes of the Meeting held at Pusa on February 17th, 1908, and following days were confirmed.

The minutes of the first day's Meeting held on February 15th, 1909, were read and confirmed.

SUBJECT II.—PROGRAMME OF THE IMPERIAL DEPARTMENT OF AGRICULTURE.

The report of Committee (a) on this subject was considered.

PROGRAMME OF THE AGRICULTURAL RESEARCH INSTITUTE, PUSA.

The scientific work of the Institute for the coming year is indicated under the programmes of the different sections.

The College has been opened and students are now being admitted. Although it is the intention that only distinguished students from the Provincial Agricultural Colleges should be sent to Pusa for a two years' course in specialising, students are also being admitted for lower courses until the Provinces are able to undertake this work themselves.

A provisional prospectus sanctioned by the Government of India has been communicated to the Provincial Governments and their replies are awaited.

The Board accepts the Programme of the Director, Agricultural Research Institute, Pusa.

The Committee considered item by item the Programmes of the Imperial Experts and recommended them for approval, subject to the remarks appended to the several Programmes. An abstract of the subsequent discussion before the full Board is in each case inserted after the remarks of the Committee.

I.—AGRICULTURAL CHEMISTRY.

1. *Soils.*—The work on the availability of plant food in soils, and the nature of the dark colour of black cotton soil will be continued.

2. *Soil moisture and water requirements of plants.* — The investigations into (*a*) the destiny of rain water, including as it does, records of drainage through soils, losses by evaporation, and surface flow; and (*b*) the water requirements of crops, will be continued.

3. *The effect of soil or manure on the composition of certain seeds* is an investigation which has been in progress tentatively and will be extended if considered desirable.

4. *The prevention of weevil attacks on wheat* is an investigation which is being conducted in collaboration with the Imperial Entomologist.

5. *Training.*—Instruction will be given to students on the lines indicated in the Pusa syllabus.

With regard to item 3 (the effect of soil or manure on the composition of certain seeds), the Committee agree that the investigation is desirable in the case of a few of the principal crops.

In answer to various enquiries as to the aim and method of the investigation on the effect of soil or manure on certain seeds, Dr. Leather pointed out the practical bearing of the work and asked that discussion of results should be postponed for a year, when fuller and more reliable data would be available.

The Board accepts the Programme of the Imperial Agricultural Chemist.

II.—Mycology.

1. *Training.*—The training of students in Mycology will be continued. Those at present under training are probationers for posts of Mycological Assistants in Provincial Departments of Agriculture. Assistance will be given to Provincial Colleges in providing notes and material for mycological instruction.

2. *Plant disease investigations.*—Work on sugarcane diseases will be continued. A further paper on red-rot will be published. The study of a new sugarcane disease has been commenced. The Supernumerary Mycologist is investigating the life history of sugarcane smut.

Assistance will continue to be given in the operations to check bud-rot disease of palms in Godaveri.

The work on pigeon-pea wilt will be published. That on the wilt of indigo is being continued. Arrangements will be made if possible for a local study of cotton wilt. Gram and other wilts will be further studied if opportunity arises.

The chief diseases of mulberry and fruit trees in Kashmir will be reported on.

The Supernumerary Mycologist is engaged in an investigation of a ginger disease prevalent in Bengal and Bombay.

The study of some anthracnoses of leguminous crops will be taken up.

3. *General.*—The survey of Indian parasitic fungi will be continued. It is hoped to complete the text of the book on Indian plant diseases.

The Committee recognise that the postponement of the study of soil fungi is inevitable, but trust that it will not be lost sight of. This work, when undertaken, will of course be carried out in consultation with the Imperial Bacteriologist at Pusa.

Mr. Hart enquired of Dr. Butler whether work on the orange disease of Assam would be discontinued. Dr. Butler replied that during the coming year, the problem would be attacked afresh in view of the negative results hitherto obtained. Mr. MacKenna mentioned ginger disease in Burma as affording scope for enquiry and undertook to send specimens to Pusa for examination.

With reference to mulberry disease in Kashmir, the President enquired of Mr. Sharma whether he would apply for an increase of staff sufficient to carry out remedial measures effectively. Mr. Sharma replied that as soon as suitable men could be found they would be sent to Pusa for the training necessary to fit them for such work. Mr. Renouf remarked that in the Punjab the inducements in the way of prospects seemed insufficient to attract suitable candidates for posts of this nature.

The Board accepts the Programme of the Imperial Mycologist.

III.—Entomology.

Part I.

1. *Research and experimental work.*—The work of the past year in studying and advising on crop pests will be continued. Assistance will be given, where desired, in directing the work of Provincial assistants and in coping with any outbreaks of pests that may occur. The issue of coloured plates of injurious and beneficial insects will be continued. Enquiries in progress on insecticides, on potato moth, on fumigating plant-imports, on the treatment of grain by fumigation will be continued as time permits. Further work on lac-cultivation will be done, both in Bihar and other parts of India in the cultivated areas; the cultivation of *eri* silk will be continued on a small scale at Pusa and assistance will be given to those carrying on the cultivation in new localities; the work in progress on spinning, weaving and dyeing *eri* silk will be continued with a view to the establishment of a cottage industry. The cultivation of mulberry and *tassar* silk on a very small scale as a demonstration to students will be begun.

2. *Training.*—The teaching of advanced entomology, commenced in August 1908, will be continued and must form a large part of the work of the section. The publication of the Manual of Indian Entomology should be completed by July and it is proposed to publish revisions in vernacular of "Indian Insect Pests."

The Committee recommend that the sentence "the cultivation of *eri* silk . . . . . will be continued," should be replaced by "considerable results have been obtained in the cultivation of *eri* (Assam) silk during the past year on a small scale and it is intended to continue this as the basis of a possible cottage industry in several parts of India."

Referring to Mr. Lefroy's Programme, the President solicited the opinion of the Board as to the advisability of including in the work on *eri* silk at Pusa such experiments as were being carried on in dyeing. Mr. MacKenna agreed with the President's view that such work should not be discouraged, referring to the excellent results obtained by Burmese villagers by means of cheap and simple methods. In reply to enquiries from Dr. Leather, Mr. Barnes and Mr. Burkill, Mr. Howlett pointed out that Mr. Lefroy's object was to introduce *eri* silk primarily as a cottage or village industry and to discover by trial a few thoroughly reliable and easily applied dyes suitable for use in such an industry. Mr. MacKenna considered such work to be entirely justifiable.

The Board accepts the Programme of the Imperial Entomologist.

Part II.

1. *Training.*—All necessary assistance will be rendered in carrying out the course of training for students at Pusa during the year.

2. *Investigations.*—More members of the Veterinary Department will, it is hoped, be sent for short courses on the methods of observing insects parasitic on, or otherwise harmful to, cattle, horses and other stock; work on these insects, on blood-sucking Diptera, and on Dipterous crop pests will be continued.

3. *Publication work.*—The work of the artists' staff of the Journal and Institute, at present under my control, will continue to be directed and supervised as hitherto.

The Board accepts the Programme of the Second Imperial Entomologist.

IV.—Economic Botany.

1. *Training.*—The teaching work of the section will be continued on the lines laid down in the prospectus of the Institute.

2. *Plant breeding and plant improvement.*—During 1909, the following crops will be studied :—Wheat, tobacco, barley, oil-seeds and fibre plants.

(*a*) *Wheat.*—The Botanical and Agricultural survey of the wheats of Bengal will be completed on the lines adopted in the investigations on the Punjab wheats. The production of improved varieties by selection and hybridisation will be continued as well as the investigation of the factors influencing the quality of the grain.

(b) *Tobacco.*—The botanical survey of the Indian tobaccos will be completed.

(c) *Oil-seeds.*—The study of the oil-seeds of India which has been carried on *on a small scale* during the past year will be extended on lines similar to those adopted in the investigations on wheat.

In recommending the Programme for approval, the Committee recognise that the work described is designed to throw light on "the scientific principles which underlie plant-breeding and plant improvement in India," a subject which the Board decided in 1906 should be a principal interest of the Department.

Mr. Howard replying to Mr. Couchman expressed his intention of visiting Madras at the earliest opportunity in order to become conversant with the work being done there on tobacco.

The Board accepts the Programme of the Imperial Economic Botanist.

V.—Agriculture.

1. *Permanent experiments.*—The permanent manurial and rotation experiments and the permanent pasture experiments will be continued.

2. *Flax and other fibres.*—Experimental work on a field scale on these crops will be continued.

3. *Sugarcane.*—Work on sugarcane as described in last year's programme will be continued.

4. *Tobacco.*—Experimental work on curing in the curing-house will be continued.

5. *Varieties.*—Wheat, Barley, Maize, Rice and Castor varieties will be tested.

6. *Threshing trials.*—Wheat threshing trials will be continued under the direct charge of a threshing expert who will be sent out by an English firm.

7. *Breeding.*—Breeding work will be considerably extended. The Montgomery herd now numbers over forty cows and will be further increased. Milk records are kept for each cow and by breeding from the best cows it is hoped that the milking powers of the herd will be substantially increased. The local herd of cows will probably be transferred to the Bengal Agricultural Department. Ewes from Bikanir and from Gorakhpur district will be crossed with Dumba rams on a fairly large scale. Seven new breeds of fowls have been received from England. There are now nineteen breeding pens in addition to ducks, geese and turkeys.

8. The general improvement of the Estate will be continued. One hundred and fifty acres will be added to the present arable area.

9. *Training* of students from the Provinces will be continued.

Item 4 should be amended so as to read "4. *Tobacco.* Experimental work on curing in the curing-house will be taken up, provided an Expert can be obtained."

The President spoke of the advantages of expert advice on tobacco curing, and Mr. Coventry mentioned that arrangements had been made at Pusa, whereby the services of an experienced tobacco curer would be available there during the coming season.

Dr. Mann urged the advisability of a careful record being kept of the results of cattle-breeding at the Pusa Farm, with the object of ultimately determining the unit characters of cattle, in the Mendelian sense. Dr. Butler and Mr. Howard pointed out that Dr. Mann's recommendations were based on a misconception of the methods adopted, which aimed at the production of pure-bred cattle by selection, not the creation or isolation of novel characters by crossing dissimilar varieties. The President was of opinion that introduction of foreign breeds of cattle was very unlikely to be of practical value owing to their susceptibility to rinder-pest and other diseases which cause extremely high mortality among such cattle and their offspring bred in India. He instanced a case of an attempt to introduce English cattle. They all died from rinder-pest. In the same outbreak, various native breeds showed immunity to a considerable extent. Mr. Knight confirmed the President's view from his own experience.

Mr. MacKenna questioned the advisability of carrying on cattle-breeding operations at Pusa. The President in reply said that cattle-breeding had been originally taken up at Pusa at the instance of the Bengal Government to provide bulls suitable for distribution in particular parts of the province. The herd consisted of the best of the local pure breed. It was maintained as such, and will be taken over by the Bengal Agricultural Department as soon as suitable arrangements can be made for this purpose. Pusa is well suited for the maintenance and development of a milking herd and with this purpose in view Montgomery cattle are kept and have done so far extremely well. Mr. Coventry expressed the opinion that cattle-breeding came legitimately within the sphere of the work of the Agricultural Department, the Veterinary Department treating cattle more from a pathological than an agricultural standpoint.

The Board accepts the Programme of the Imperial Agriculturist.

VI.—Agricultural Bacteriology.

Some of the following problems will be attacked as opportunity offers and time permits:

I.—The chief bacteria characteristic of Indian soils, particularly those taking part in—

(a) The fixation of Nitrogen.
(b) The rotting of organic material
(c) Nitrification

II.—The characteristic organisms growing in association with leguminous crops in India, with particular regard to the inoculation of the soils growing them.

III.—The bacteria taking part in the rotting of stored organic material under Indian conditions and the bearing of the knowledge gained on the conservation of cattle-manure in India.

IV.—The fermentation-processes accompanying the manufacture of tobacco.

V.—The fermentation-processes taking place during the manufacture of tobacco.

VI.—The fermentation-processes taking place during the manufacture of indigo.

VII.—Any bacterial diseases of important Indian crops.

The Committee wished to place on record their view that steps should now be taken to carry out the investigations referred to in the Proceedings of the Board, 1908, page 36, which they regard as of fundamental importance to the country as a whole.

Mr. Moreland referred to the great importance of a knowledge of soil organisms with reference to questions of tillage and manuring in the Gangetic Valley.

The Board accepts the Programme of the Imperial Bacteriologist.

COTTON.

1. To visit and advise in any Province when he is requested to do so.

2. To assist in making special investigations into the distribution of Indian Cottons in the field throughout the country, more especially for the purpose of ascertaining exactly where the most valuable forms of each variety are grown and to discover, if possible, the natural causes which favour these.

3. To arrange for trial with superior varieties already discovered, such as (1) with *Karkheli* Cotton in the Central Provinces, Kathiawar, Berar, Khandesh and the Deccan, where inferior varieties of the same type are already grown; (2) with *Navsari* Cotton (the most valuable form of Broach) in Gujarat, Southern Mahratta Country and the northern parts of Madras; (3) with *Bourbon* Cotton in the heavier rainfall tracts of the West Coast.

The Board accepts the Programme of the Imperial Cotton Specialist.

SUBJECT III.—PROGRAMMES OF PROVINCIAL AND NATIVE STATES DEPARTMENTS OF AGRICULTURE.

The report of Committee (b) was considered. The Committee's remarks on the respective Programmes together with their subsequent discussions by the Board are printed at the end of the Programme to which they refer.

UNITED PROVINCES OF AGRA AND OUDH.

Agricultural stations.

Four agricultural stations are in existence, and two more will be organised during the year. These stations serve as local centres of the practical work of the department,—demonstrations, advice and assistance, and supply of seed and implements: an experiment farm is attached to each, but the importance of the experimental work differs widely from station to station.

At *Cawnpore* the experiments relate mainly to fundamental questions such as the gain and loss of nitrogen and the behaviour of water in soils. At *Orai* the central problem is to increase the diversity of cropping. *Aligarh* is concerned mainly with the improvement of cotton; while *Partabgarh* will eventually take up outstanding questions connected with the growth of sugarcane, but at present experiments are a minor feature of this station.

Of the new stations *Atarra* is situated in a part of Bundelkhand where irrigation is being introduced for the first time, and is designed to pioneer the improvements in the local agriculture rendered possible by this change. *Benares* is being organised in response to a strong local demand for practical assistance, voiced by influentially-signed memorials, and for the present the experimental programme will be unimportant.

A few sub-stations exist for the study of special problems, at present the barren and alkaline lands and the ravines.

The chief lines of experimental work may be stated as follows:—

Cotton.

The Economic Botanist will continue his study of the genus *Gossypium*; determination of the varietal characters and study of their inheritance. The Deputy Directors at Cawnpore and Aligarh will continue the selection of indigenous and foreign acclimatized cottons, plants being chosen for length and strength of fibre, prolific production and absence of fuzz on the seed.

The distribution of acclimatized American seed and organisation of a market for the produce will also continue from the same centres; and the demand for indigenous seed in Bundelkhand will be met from the Orai station. The suitability of different varieties of cotton to Bundelkhand soils will continue to be tested at Orai.

Wheat.

The Economic Botanist will continue the classification of the wheats of the province based upon observation of the growing plant. At Cawnpore the outturns of certain pure strains are being compared in connection with reports on the milling values obtained from a firm engaged in the industry.

Trials of varieties and crosses for resistance to rust and general suitability to local conditions will continue at Orai.

Sugarcane.

Important local varieties of cane are being tested at Partabgarh, and the Agricultural Chemist will continue his examination of them with a view to determining some of the factors that influence the composition of the juice.

The demonstration of Mr. Hadi's methods of sugar manufacture will continue, and the Agricultural Chemist will determine the losses at the different stages of these methods, with a view to their further improvement.

Other crops.

Other crops under investigation at Cawnpore include poppy, *Cassia auriculata* (as a field crop, to meet the needs of the tanning industry), *Prosopis juliflora* (as a fodder plant for poor land), cassava, *Melilotus officinalis* and *Asclepia semi-*

Junata (as a fibre plant). At Orai oats and ground-nuts have proved successful and are being taken up by cultivators; the minor crops just named are being tried at Orai also, and in addition spineless cactus, agaves, and date palms. Numerous new varieties of potatoes are being tested for suitability to the Himalayan tract.

Manures.

The various long-term experiments at Cawnpore will be continued. Calcium cyanamide and nitrate are being tried, and also the refuse of local cotton and sugar-factories. Sulphate of ammonia is being tried on sugarcane at Partabgarh. At Orai, where manuring is little practised, the behaviour of different soils when irrigated and manured is under observation, the manures employed being cattle-manure and poudrette. At the same station an attempt is being made to reclaim a portion of the bad land (known locally as *rakar*) by enclosing and heavy manuring with poudrette.

Tillage.

The tillage experiments at Cawnpore will continue. At Orai the cultural requirements of the different soils are being studied both generally and in relation to the elimination of *kans*. The trial of the lighter forms of the turn-wrest plough for both purposes is being taken up this year.

Soil moisture.

The experiments in connection with soil moisture will continue at Cawnpore. An addition has been made (in conjunction with the Imperial Agricultural Chemist,) of an investigation to determine (*a*) Losses of soil-moisture by cropped land under different crops with and without manure: these experiments being a duplicate of those at Pusa and being further duplicated on four types of soil at Orai. (*b*) Losses of soil-moisture from land irrigated with an accurately measured quantity of water, (*i*) bare fallow, (*ii*) grass and weeds, (*iii*) wheat.

Barren land.

Cultural experiments have been abandoned on the heavy non-alkaline clays, while on alkaline soil they are limited to the use of gypsum in order to have data available should this mineral ever become available at paying prices: at present the cost is prohibitive. On non-alkaline clay it has been ascertained that trees cannot be grown successfully unless the holes are carried right through the clay: the economic possibility of this practice is being determined, the holes being pierced by an auger. An exception to the general rule is found in the case of the dhak (*Butea grondosa*), which if given a fair start is able to penetrate the clay, and coppices freely. Lac is being established on the dhak trees, and if these can stand the drain on their vitality it seems possible that the cultivation of *dhak* on such land may be economically profitable.

Attempts are being renewed to improve the value of the ravine lands for pasture by causing more of the rainfall to sink in instead of running off, and holding up water in the higher parts of the ravines, masonry work being dispensed with as far as possible.

Irrigation.

Experiments continue to determine the most suitable form of percolation well: and to ascertain the conditions of economical power-pumping from spring wells in the alluvium. The development of power-pumping from lakes and rivers has been assigned by Government to the Irrigation Department. The demand for boring in wells continues to expand and is being met as rapidly as possible on the lines already known.

Work of the Economic Botanist.

The programme of the Economic Botanist comprises, in addition to the supervision of the biological side of the Agricultural College, the investigations on wheat and cotton enumerated under those heads, and an examination of the forms of agave found in the province and their distribution.

Work of the Agricultural Chemist.

The programme of the Agricultural Chemist comprises in addition to the supervision of the chemical side of the College and ordinary analytical work, the investigations in connection with sugar referred to above, and also an examination of the composition of sugars as actually sold, a point on which information is

required by Government. Mr. Clarke will also take up an investigation into the constituents of the juice of agave with a view to their industrial utilisation, but is not yet in a position to indicate the scheme that will be followed.

Agricultural College.

The Agricultural College is now in working order and no remarks are required regarding it.

Implements.

The demand for the simpler forms of implements is growing rapidly, and attempts are being made to meet it by the organisation of increased numbers of local centres where land-holders will undertake the management

Seed.

The necessity of Government seed-farms has so far not arisen as it is found possible to meet requirements otherwise, and there are hopes of the development of a seed-growing industry in private hands, which it is the object of the department to foster. The development of co-operative seed-societies has been suspended owing to the recent high prices, but will be resumed when prices fall: meanwhile the operations of the Oudh seed-depôts will continue on a somewhat extended scale, and the requirements of private indentors will be met.

Demonstrations.

It is hardly possible to summarise the programme of demonstrations which is constantly varied in the attempt to meet the needs of particular localities. The most important item consists of the sugar-factories worked by Mr. Hadi's methods which are referred to above.

Publications.

The issue of the vernacular *Agricultural Journal* will continue, and leaflets will be issued as occasion arises.

Poultry breeding.

The supply of high grade poultry for breeding is being taken up by the Rampur State, the enterprise being subsidised by the Local Government in its initial stages.

Horticulture.

A horticultural station has been established in the Kumaun hills designed to promote the development of fruit and vegetable-growing, mainly for the supply of the plains during the hot weather. Application has been made for a European horticulturist to take charge, whose duties will be to introduce the best varieties and at the same time to bring consumers into touch with producers and organise regular supplies to the principal markets.

The departmental horticultural stations at Saharanpur and Lucknow are now in process of gradual re-organisation, the principles being the gradual withdrawal from the ordinary business of the nurseryman, assistance to the development of this business in private hands, and the devotion of more attention to horticultural education and demonstration and to introduction of new species and varieties of economic value.

Regarding the permanent experiments at Cawnpore, Dr. P -r informed the Committee that the permanent experiments are to be re-considered this year by the Agricultural Department of the United Provinces.

The Committee considers that in future, fundamental problems of this nature should be investigated at one central station for the whole of India rather than be taken up in separate Provinces.

In reply to questions, Dr. Parr entered into a full explanation of the features of the Programme. The Committee approves the Programme on the assurance that the programme as it stands is not beyond the capabilities of the European and Indian Expert Staff.

The Board accepts the United Provinces Programme.

PUNJAB.

1. The reh investigation in collaboration with the Agricultural Chemist, Punjab, will be continued as soon as the Lyallpur laboratory is ready. The results of preliminary observations have been reported and submitted to Government.

In accordance with the orders of Government the enquiry will be in the first place concentrated mainly in the Chenab Canal Colony.

2. The type of wheat-reaping machine has been improved in certain details. Arrangements have been made to transfer the commercial part of the transactions to a local agency. This will relieve the Department of a considerable amount of trouble, entailing a corresponding expenditure of time. Efforts will be made to give the utmost assistance to purchasers of machines in the way of instruction in their care and use.

3. Winnowing-machines are in demand, but the Department consider that they have not yet obtained a sufficiently efficient machine for exhibition. A specially adjusted machine, which gave good results on trial in England, is being imported, and, if equally successful here, will be exhibited in various centres during the ensuing cold weather.

4. The Hadi sugar-making plant will be tried at Lyallpur, so as to facilitate certain laboratory tests. In addition, enquiries will be started to ascertain whether in normal years the sucrose percentage of the Punjab sugarcanes is sufficiently high to ensure a profit with this plant. In this connection it is proposed to start an enquiry as to the possibility of the introduction of more efficient cane-crushing mills.

5. The distribution of Dharwar Acclimatised American Cotton Seed will be continued. The area sown this year shows a decrease from 2,000 to 600 acres. This is mainly accountable for by the bad season last year. Improved arrangements for the disposal of the produce by auction are being given a trial this winter.

6. The organization of the Jullundur Agricultural Station will be undertaken immediately on the acquisition of the site.

7. Further outside trials of Egyptian cottons will be discontinued until more experimental work has been conducted at the Lyallpur Station.

8. The fodder-scarcity investigation in the south-eastern part of the Province will be continued.

9. The question of sub-soil ploughing will be taken up as soon as possible after the opening of the Jullundur Station, where an excellent opportunity offers in the shape of a worn out soil.

S. MILLIGAN,

Deputy Director of Agriculture, Punjab.

The College.—The opening of the College in July 1909. The preparation of a course and, as Principal, the framing of the College curriculum, prospectus and rules, the completion of the equipment, and the laying out of the estate.

Chemical work.—After dealing with the educational work, the following chemical problems will be investigated if time permits:—

(1) Continuation of the investigation of the composition of the alkali lands of the Province combined with the reclamation experiments in the field.

(2) In connection with the above problem, an experimental investigation of the type and quantity of salts absorbed by plants, and the limiting value of salinity for the germination of the more important crops.

(3) The manufacture of crude sodium carbonate from salt bush.

(4) An analytical examination of the value of the Mr. Muhammad Hadi's sugar plant under local conditions.

(5) Silt analyses.

(6) An examination of special soils in connection with the disease hæmorrhagic septicæmia. (In collaboration with the Civil Veterinary Department.)

J. H. BARNES,

Principal, Punjab Agricultural College, and Agricultural Chemist, Punjab

1. *The College.—Preparation of the course of instruction in view of the proposed opening of the College in July next.*

2. *Lyallpur Agricultural Station—*

(*a*) About 14 acres of land will be brought under cultivation and laid out as the students' farm.

(*b*) Fresh land will be tested for uniformity in view of future experiments.

(*c*) The permanent experiments are being slightly modified owing to the fact that all variety experiments are being handed over to the Economic Botanist, who will perform such work on land set apart for that purpose.

(*d*) Experiments with manures will be systematized. Tests will be instituted to ascertain the amount of water required by wheat and cotton under irrigation, and observations of the effect of surface cultivation on different crops and soils will be taken up.

(*e*) Seed growing and seed distribution will be continued. Four hundred and twenty-one maunds of various seeds were distributed in 1907-08.

(*f*) Trials of machinery, including American cultivators and seed drills, improved harvesting machines, etc.

3. *Other work—*

(*a*) Organization of the office.

(*b*) Touring to obtain information on the problems of the Province generally and to prospect for an agricultural station in the South-West Punjab.

(*c*) Investigation of reh with the other officers of the Department.

(*d*) The question of poultry with a view to improving the poultry of the Province.

(*e*) Starting a depôt for agricultural machinery. Cultivators have already been supplied to a certain number of agriculturists.

H. H. CORBIN,
Professor of Agriculture, Punjab Agricultural College.

The College.—A considerable amount of work will still have to be done in filling in the details and getting the College quite ready for students, but it is to be hoped that much less of the personal attention of the Economic Botanist will be required than has been the case in the past.

The only assistant available when the College opens will be the Assistant Professor of Entomology, and much time will, therefore, be occupied with preparing definite courses of study and the teaching of students. There is still a considerable amount of work in connection with the details of the College fittings.

A large part of the time before the College opens in 1909, will be spent in getting thoroughly acquainted with the cultivated crops of the Province, their relative importance and the conditions in which they are grown.

Considerable time will also be spent in getting acquainted with the flora in general, especially commoner farm weeds and other plants of importance.

Training of the subordinate Economic Staff.—A good deal of personal attention will also be required in training the subordinate staff in connection with the economic work, as these men will be quite new to their duties.

Fruit culture.—An area of ground will be set down in fruit trees to represent those of economic value of the Province. This will be extended as soon as possible to include those of other provinces and countries which are likely to be of economic value if introduced into the Punjab.

Teaching collection.—A collection of plants chosen as far as possible from those of direct or indirect economic importance, and common in the Province, will be planted, to illustrate the natural orders which the students will study.

Flax and Jute.—Further investigations and experiments in growing and retting flax and jute will be carried on with a view to ascertaining whether these could be profitably introdnced as farm crops in the Province.

Cotton.—A collection of the cottons of the Punjab and North-West Frontier Province has been made, and the botanical survey of these will be continued. Plant to plant selection and hybridizing will be continued. Some new Egyptian varieties are under observation.

Wheats.—The Imperial Economic Botanist has completed a survey of the wheats of the Province. These will be kept pure as far as possible and the best of them multiplied up for distribution. Plant to plant selection and crossing will be continued. Improved varieties from outside will be sought for.

Cassavas.—Experiments in growing cassavas will be made with a view to ascertaining whether cassava can be grown in this Province as a cheap food crop.

Entomology.—There is one Agricultural Assistant in this section at present. The work to be done includes the collection of notes on the insect pests common in the Province, and the formation of a good teaching collection.

Attention will be given to outbreaks of pests in the districts, and assistance will be given to check or cure them, notes being kept as far as possible of the result and cost of the remedial measures.

The investigation of the parasites of bollworms will be continued.

D. MILNE,
Economic Botanist, Punjab.

The following items should be added to the above :—

(1) Experiments in certain districts with a view to the revival of sericulture.

(2) The training and organization of a small staff of well borers who will work on lines similar to those adopted in the United Provinces.

(3) A well survey of certain districts in which there is a chance of extending well irrigation.

W. RENOUF,
Director of Agriculture, Punjab.

In the investigation of *reh* problem, the Committee considers that there is need for continual collaboration between the various Provincial Departments concerned. This is a large question which is about to be taken up in several Provinces and the Committee suggests that it might be formally discussed with advantage at the next meeting of the Board. The Punjab Programme is approved.

The Board resolved that a Committee consisting of Dr. Leather, Mr. Milligan, Mr. Barnes, Mr. Henderson, Dr. Mann, Mr. Harrison, Dr. Parr and Mr. Burt be appointed to consider the question of salt lands in India during the coming year and to submit a report to the Board as a basis for discussion at its next Meeting. This report should show the extent and character of the salt lands in each Province as far as ascertained, and where possible should be illustrated by maps. The results of previous work should be examined and lines of work for the immediate future recommended.

BOMBAY.

The energies of the Department are chiefly employed in the following lines of work:—

(1) *Wheat.*—All the wheats grown in this Presidency have been collected, and these together with some varieties from the Punjab and the United Provinces, and also several foreign varieties, are being tried at a number of the stations. These varietal tests are accompanied in every case by individual selection with a view to increasing (*a*) rust-resistant qualities, (*b*) yield, (*c*) quality.

(2) *Cotton.*—It has now been demonstrated that Egyptian cotton can be grown with success in Sind at a good profit, and this fact is now to be demonstrated on a larger scale on the Jamrao Canal, in order to induce the Sindhis to cultivate it properly. Upland American cotton is also to be tried in Upper Sind.

The cultivation of Broach cotton is now an established success in the Southern Mahratta Country, and efforts are to be made to push its cultivation there. Trials of Cambodia cotton at Dharwar are also promising and are to be continued.

The relative advantage of Broach cotton over the local variety will be tested in the Ahmedabad District.

The various constituents of the mixture of cottons usually grown in Khandesh have now been separated and tests of their relative value in cultivation are to be continued.

The improvement of cotton by plant to plant selection has been in progress for some time and will be proceeded with during the coming season.

We have now a number of hybrid cottons, and are yearly selecting from their produce, with a view to obtain a fixed type of cotton of superior quality. We have by this means obtained two hybrids which appear to be fixed within the limits of individual variation. The hybrids, however, as a whole, show great instability, and we have so far found great difficulty in determining to what extent this instability is due to fluctuating variations, how far to actual differences which breed true, and how far to fresh hybridisation in the field. We are also making fresh crosses, and selecting on Mendelian principles from the seed produced.

3. *Sugarcane and 'Gul'-making.*—Plant to plant selection is to be applied to the well known "Pundia" cane, using (*a*) the cultural characters of the cane, and (*b*) the composition of the juice, as the guiding characters.

Further experiments are also in progress as to the best intervals between the watering of sugarcane, and the amount of water to be given at one watering.

The manurial treatment of sugarcane has been long under investigation, but experiments are still in progress on the following questions:—

(*a*) the relative value of mineral nitrogenous manures and oilcake as a top-dressing,

(*b*) the advantage of adding potash and phosphoric acid under Deccan conditions,

(*c*) the most economical combination of oilcake and artificial manures as a top-dressing.

One of the new lines of investigation concerns the influence of soil, manure, time of planting, character of watering, age of cane and methods of boiling on the quality of '*gul*' produced from the Deccan canes. In connection with this an attempt is in progress to ascertain the factors which determine the value and the keeping qualities of '*gul.*'

The question of the position of sugarcane in a rotation, and hence the best crop to precede it, is also under experiment.

A power plant for crushing cane has been installed at Manjri, and its economy, as against the ordinary form of bullock crusher, is to be further tested.

It is also intended to compare the profits obtainable under Poona conditions from the usual '*gul*' manufacture with those obtained in sugar-making by the 'Hadi' process.

4. *Jowari.*—The work on this crop consists of—

(*a*) variety tests to determine the best varieties for particular conditions,

(*b*) plant to plant selection to improve yield,

(*c*) the investigation of the smuts which attack the crop with a view to obtaining a smut-resistant variety adapted to different districts.

5. *Rice.*—The experiments on rice are almost entirely concerned with the practice of burning '*rab*' on the rice seed-bed before sowing the rice. So far the results appear to indicate that the heat is the main factor in the value of the method, and that its effect is principally a biological one. The whole question of the cause of the effectiveness of the method is under investigation with the ultimate idea of obtaining an economical substitute for the '*rab*' process.

6. *Ground-nuts.*—Very variable results have been obtained as to percentage of oil in both foreign and indigenous ground-nuts grown under different conditions. The causes which determine this variability will be worked out as far as possible, and the best varieties suited to different conditions both as to richness in oil, yield, and freedom from disease, determined.

The value of growing ground-nut as a mixed crop with cotton, jowari, or plantains is also under investigation.

An attempt is being made to discover a type, from the local variety, resistant to *ticca* disease, accompanied by investigation of the method of infection.

7. *Tobacco.*—One of the farms of the Department (Nadiad) is largely devoted to tobacco culture, and this year the growth of foreign tobaccos under shade is being investigated. The curing experiments already initiated as to preparing tobacco in a properly constructed 'drying house' will be continued.

8. *Potatoes.*—Trials at three stations are being made with seed from England, Scotland, France and Italy.

9. *Tur.*—The investigation of the disease of *tur* known as 'wilt', already commenced by Dr. Butler, will be continued in consultation with him. This involves the selection of resistant types, and the attempt to breed from these a strain which is relatively immune to the disease.

10. *Manures.*—In addition to the manure experiments noted under the foregoing headings, the value of rotted Cactus (prickly pear) as a general manure and the economy of nitrogenous top-dressings to cotton, jowari, wheat and tobacco will be further tested.

11. *Cultural Experiments.*—As the principal need of the agriculture of the Deccan appears to be that of water, a series of experiments has been initiated to determine the best way in which the moisture which actually falls on the land can be conserved. The methods under trial include the use of deep-ploughing, subsoil packing, the damming of small streams, harrowing after rain previous to sowing, interculture after rain after sowing, etc.

12. *Entomology.*—The best action to take against (1) The potato moth, (2) the boll-worm, (3) white-ants, (4) the cotton mite, (5) cut-worms, will be further investigated.

13. *Seed Distribution.*—The following seeds and plants are now distributed on a fairly large scale :—

American cotton in Upper Sind.

Egyptian cotton and Berseem on the Jamrao Canal.

Broach cotton in Upper Gujrat and in the Southern Mahratta Country.

Ground-nut (exotic varieties) in many localities.

Tapioca sets, and Pundia sugarcane sets are also to be widely distributed.

14. *Seed-testing.*—It is proposed to establish a seed-testing station in connection with the Poona Agricultural College.

15. *Mechanical.*—Most of the work of the Department in this direction is connected with the raising of water for irrigation purposes. Experiments have been started in Gujrat in well boring, with the object of ascertaining how best this can be carried out, and of establishing a connection between the character

of the strata and the supply of good subsoil water for irrigation purposes. In the Deccan, the economy of using fairly large sized oil-engines to pump water from rivers and to crush sugarcane thus grown under irrigation, will be tested.

The relative advantage of all kinds of waterlifts for raising water to different heights, and their suitability to the various local conditions, is under investigation.

During the year, it is proposed to establish a workshop in connection with the Poona Agricultural College, for the improvement and experimental manufacture of iron ploughs, chain pumps, chaff cutters, and other agricultural implements.

16. *Demonstration and District Work.*—It is proposed to develop this side of our district work considerably.

Among the most important of the introductions to be pressed by means of demonstrations are the following :—

(*a*) The use of the turn-wrest plough in tracts where the people now require *ten to twelve* bullocks to work the heavy wooden plough.

(*b*) The use of the Egyptian plough and leveller in Sind.

(*c*) The more widespread use of the Poona furnace in '*gul*' boiling, which will save the people in some districts at least Rs. 30 per acre of sugarcane grown.

(*d*) The use of pickling seed against smut.

(*e*) The proper conservation of cattle manure.

(*f*) The use of oilcakes and sulphate of ammonia as top-dressings for sugarcane.

In addition to this, the activities of the Department will be devoted to fostering the development of the agricultural associations which are now being formed.

G. F. KEATINGE,
Director of Agriculture, Bombay.

Mr. Knight having explained the present position of Egyptian cotton in Sind, the Committee is of opinion that in introducing a new crop which demands a higher standard of cultivation than that prevailing in the locality it is of paramount importance to proceed slowly, and to demonstrate the profits to be derived from higher cultivation.

Referring to the importation of seed potatoes from abroad, the Committee desires to emphasise the danger of introducing new pests or diseases. The Programme is approved.

In answer to questions by the President, Mr. Knight gave details of the experiment designed to ascertain the effect of several varying factors on the quality of *gul*. Mr. Burt referred to the difficulty of getting reliable results owing to the great influence on the final product of small variations in method of preparation, and the President expressed the view that the experiments as planned were probably too complex to give practical results. Dr. Butler, Dr. Coleman and Mr. Howard were of opinion that the work on smut-resistant jowar was unlikely to prove a profitable line of enquiry in the light of past experience.

The President enquired as to the value of the introduction of American cotton in Sind, and Mr. Keatinge replied that it compared very favourably with Egyptian cotton of which none at all had been sold this year, though of the same quality as the last year's which sold well. With regard to the remarks of the Committee he was of opinion that a large quantity of cotton was necessary if accurate market values were to be obtained and that if the amount were curtailed the market would be lost. Mr. Noël-Paton said that a large output was advisable to attract a market.

Mr. Hemingway believed that the extreme fluctuation in the price of Egyptian cotton since last year was in reality due to jealousy among professional bidders which led to artificial inflation of the price of last year's output.

The Board accepts the Bombay Programme.

MADRAS.

1. *Agricultural Stations.*—The Attur Agricultural Station has been given up, as it appeared that no useful work could be done there. The abandonment of the Bellary Agricultural Station has been proposed to Government, the land being unsuitable for experimental work. It has also been proposed to abandon the experiments in the irrigation of black cotton soil on the Hagari Agricultural Station, as they did not seem likely to lead to any practical result. If these proposals are approved, the Hagari Agricultural Station will become the centre for work on the cottons of the variety known to the trade as "Westerns," and the work on the improvement of the local cottons commenced at Bellary will be transferred there.

Under the orders of Government the District Board Farm at Bezwada has been taken over by the Department. The lines of work here have not yet been settled. Preliminary investigations into the paddy cultivation of the Kistna and Cauveri Deltas have been set on foot, with a view to seeing if there is work to be done there which would justify the opening of Agricultural Stations. The two deltas represent about 1,500,000 acres of paddy cultivation.

2. *Crops—Paddy.*—The spacing and planting experiments referred to in last year's programme will be continued at Palur, Coimbatore, Samalkota and Taliparamba, and also the experiments in growing green manuring crops such as *Tephrosia purpurea*, horse gram, indigo, sunn-hemp and green gram. The amount of water required to raise a full crop of paddy will be tested at Coimbatore and Samalkota. The composition and existing supply of "pati mannu" or old village-site earth, so largely used for the paddy crop in the Kistna Delta, has been investigated by the Agricultural Chemist, who has also commenced a series of experiments in the delta with an artificial substitute for this manurial earth. The information collected up to date forms the subject of an article in the January number of the *Agricultural Journal of India*. They will be continued and extended during the current year. At the suggestion of the Honorary Director of Fisheries, experiments will be made in the use of fish-scrap (fish, from which the oil has been extracted) for paddy, especially on the West Coast where it is produced.

3. *Sugarcane.*—The Mauritius sugarcanes introduced by the Government Botanist having almost ousted the local canes in the Godavari Delta, attention will now be mainly devoted to the testing of new varieties. The canes grown on the "Upland" nursery having proved quite free from fungus disease, which has been very severe on the Samalkota farm, the upland nursery will be extended in the current year, and the farm planted exclusively with canes from this nursery. The Government Botanist will visit the other chief cane-growing centres of the Presidency to see if the Mauritius canes could be successfully introduced anywhere else. The Red Mauritius cane has been successfully introduced into the South Arcot District. A Hadi boiling plant will be erected at Coimbatore and Samalkota with a view to improving the local manufacture of jaggery.

4. *Cotton—Seed distribution.*—In Tinnevelly pure Karunganni seed sufficient to sow 7,000 acres was distributed. Seed is being grown for the Department by ryots on 250 acres, advice and assistance being given to ensure good cultivation. Seed for 15,000 acres will be available for next year. It is intended to develop this work up to the point where it will have a well-marked influence on the cotton crop of the district. A commencement has been made in Kurnool by the distribution of a small quantity of white Northerns and Gadag seed.

Cultivation.—About 1,000 acres of ryots' land in Tinnevelly have been sown with the drill with the help and advice of the Department, implements and trained coolies being lent. This line of work is promising and will be developed as rapidly as possible. The advantages of drilling most appreciated by the ryots are, that a larger area can be sown in a day, and that sowings can be continued for a longer time after the rain stops.

In part of the Trichinopoly District where cotton is grown as a mixed crop, a few ryots were induced to try sowing it as a pure crop, with the use of the drill. This line of work will be developed, if promising. At Hagari and Nandyal, where the ryots use the drill, but sow too much seed and do not thin their crops, spacing of the crop by subsequent thinning is the chief line of work. Different

distances are being tried. The permanent cotton manurial experiments at Bellary and Koilpatti will be given up, as they do not promise to give any practical results.

Cotton improvement.—(*a*) Selection of the best plants of the local cottons will be continued at Hagari, Nandyal, Koilpatti and Coimbatore, and increased attention paid to this subject. Details of the lines of work will be found in the scientific reports on the Koilpatti and Bellary Agricultural Stations for last year.

(*b*) Crosses between the local cottons both *inter se* and *intra se* will be studied at Koilpatti and Bellary, with a view to their improvement by selection.

(*c*) Rotation experiments with cereals and other crops will be continued.

(*d*) *Exotics.*—With the exception of Cambodia cotton, which has done well at Koilpatti and is well thought of by the ryots, especially as a partly-irrigated crop on garden lands, work on exotic cottons will be confined to scientific observations at Coimbatore by the Government Botanist.

The abandonment of the Hagari pumping experiments will involve giving up the cultivation of Egyptian cotton. So far it has never done well there.

(*e*) The 'Salems' cottons, which include Bourbon, Nadampatti and Uppam will be studied, and pure samples of lint will be collected for valuation.

5. *Ground-nut.*—(*a*) Exotic and other varieties will be studied at Palur, for comparison with the local variety.

(*b*) The permanent manurial experiments, and the attempts to improve the local methods of cultivation and irrigation will be continued.

(*c*) The rotation of ground-nut with other crops will continue to receive attention. The rapid spread of this crop to new districts, where the cultivation is not understood, has given increased importance to this subject.

(*d*) Ground-nut as a rain-fed crop is rapidly spreading on the West Coast, where it was unknown before, and where a new and profitable crop for the dry lands, hitherto much neglected, is a decided want. Seed will again be supplied free in some cases and at cost price in others, and help and advice given where required.

6. *Pepper.*—The study of the cultivation of pepper will be continued at Taliparamba on the lines originally laid down.

7. *Fibre crops.*—The continued high price of rice coupled with the fall in the price of jute, has made the prospect of introducing jute less promising. The experiments in Tanjore were unsatisfactory, and only a few plots on the West Coast did well. This work will be held in abeyance till an Agricultural Station can be opened where the cultivation can be properly studied.

8. *Irrigated dry crops.*—At Coimbatore irrigation by ridge and furrow will again be tried against the local flat-bed system, the water being measured to see which system is most economical of water. At Koilpatti the ridge and furrow system continues to give better results on red soil.

9. *Miscellaneous.*—Natural pasture grasses are being studied under cultivation at Taliparamba, where fodder for cattle in the dry weather is a great want. Cassava and ginger crops, already largely grown on the dry lands of Malabar, will be taken up for study.

10. *Economic Botany.*—Lectures in Economic Botany, Entomology and Mycology will be prepared under the direction of the Government Botanist. The biological collections, including the herbarium, will be transferred to Coimbatore as soon as the rooms at the college are ready to receive them. This work, together with the furnishing and fitting up of the new laboratories, will occupy most of the time of the staff, but as soon as this is done a general study of the crops of the Presidency will be commenced, especially as regards their varieties and distribution.

Specific lines of work will be, the mode of fertilization of pepper, the true nature of the flowers of the ground-nut and the mode of fertilization in the field of ground-nut, gogu (*Hibiscus cannabinus*) and cotton. Studies in Mendelism will also be commenced on these three plants. Mutations will be carefully studied wherever observed, both in cultivated and wild plants.

In Mycology little will be done till trained assistants are available. One is now at Pusa under Dr. Butler.

In Entomology work will be continued on the present lines under the general direction of the Imperial Entomologist. Work will include bagging and light-trap experiments against the surul (*Anacampsis nexteria*) of ground-nut, light-trap experiments for the hairy caterpillar (*Creatonotus albistriga*), on cumbu (*Pennisetum typhoideum*) and ground-nut, and light-traps and ploughing-in of the stubble against the paddy stem-borer.

11. *Chemistry.*—Work is at present being carried on in temporary laboratories. The permanent laboratories will be fitted up early in the year both for teaching, and analytical and research work. Much time will be taken up with preparing the lectures and practical work for the students. The work of routine analysis is increasing rapidly, and will occupy a large proportion of the time of the staff, but attention will be paid to the following investigations and research work :—

(1) The substitution for the Pati-mannu of the Kistna District, of suitable manures.

(2) The manurial requirements of paddy, and the study of the paddy soils of the Presidency.

(3) Systematic examination of the soil of the Central Agricultural Farm.

(4) In conjunction with the Deputy Director of Agriculture, Southern Division, work on the saline lands of the Periyar Delta.

(5) A study of the fermentations occurring in paddy soils during the period of cultivation.

12. If time permits, preliminary work will be carried out in the following subjects :—

(*a*) A Systematic survey of the tank and river silts of the Presidency.

(*b*) The ripening of sugarcane, and the changes occurring in the juice during the period of growth.

(*c*) Systematic study of the black cotton soils of the Presidency.

M. E. COUCHMAN,
Director of Agriculture.

Referring to the abandonment of the Attur Agricultural Station, the Committee would call attention to the necessity for ascertaining by careful preliminary investigation the suitability of the land for experimental purposes before spending money on buildings and equipment.

The Madras Programme is approved.

With reference to the Committee's comment on the programme, Mr. Couchman explained that at Attur an oil-engine had been used for pumping water for irrigation, but that the Farm had been given up because the soil was found to be too sandy to grow good crops. The Board accepts the Madras programme.

CENTRAL PROVINCES AND BERAR.

I.—General.

Agricultural Stations.

There are four Agricultural Stations in these Provinces—Nagpur, Raipur, Hoshangabad and Akola. These serve a double purpose, (1) as experimental stations and (2) as central depôts from which selected seed, good bulls and improved agricultural machinery can be obtained. The Raipur station is situated in the rice tract, Akola in the cotton tract and Hoshangabad in the wheat tract. The experiments at these stations are devised to solve problems relating to the staple crop or crops grown in the tracts in which they are situated and to introduce new ones. The crops experimented with at the Nagpur Station are of a more varied type, as are also the crops of the surrounding country. This station moreover serves as a College Farm on which the students of the Agricultural College get a practical knowledge of all important crops grown in the Provinces. At all the

stations the programmes of experimental work have been revised in the light of past experience, so as to simplify the issues and improve the standard of work.

II.—Section under the Deputy Director of Agriculture, Southern Circle.

Cotton.—The chief experiments with cotton will be carried on as formerly at the Akola Farm under the supervision of the Deputy Director of Agriculture, Southern Circle. The experiments deal with (1) rotation of crops with cotton as the principal crop ; (2) tillage experiments to test the comparative values of the bakhar, country plough and Ransome's Turnwrest Plough as implements of cultivation for black cotton soil when cotton and wheat are grown in rotation ; (3) spacing experiments to determine the distance apart that cotton should be grown in unmanured black cotton soil in order to give the best results ; (4) topping experiment to ascertain how far the yield of jari cotton can be increased by removing the leading shoot when the plant is about one foot high so as to encourage the branching habit of the plant; (5) to determine the relative values of the indigenous and exotic varieties of cotton grown in these Provinces and how far their yield can be increased by seed selection ; (6) to test the comparative values of different locally obtainable manures and imported fertilizers, including cattle-dung, poudrette, urine-earth, saltpetre, nitrate of soda, sulphate of ammonia, superphosphate and sulphate of potash ; (7) to compare the outturns of the best juars ; (8) to determine whether cotton and juar can be sown with advantage before the rains ; (9) to test the value of gram and certain other legumes as soil renovators when grown along with cotton, the gram being sown between the rows of cotton after the last weeding of the latter ; (10) to compare the values of the best grasses grown in the Provinces (*i*) for fodder and (*ii*) for pasture, the work being done in conjunction with Mr. Graham, the Economic Botanist

Akola Farm.

The quantity of cotton and juar seed propagated from the best of the mother-plants selected within the last three years will supply sufficient seed for the whole farm area under these crops.

Rice.—Experiments on rice cultivation will be carried out according to the revised programme on the Raipur Farm under the supervision of the Deputy Director of Agriculture, Southern Circle. The experiments are designed to test (1) the different methods of cultivating rice with and without irrigation ; (2) to test the manurial values of cattle-dung, calcium cyanamide, bone-dust, dried leaves, tank-silt, castor-cake, poudrette and night-soil when applied (*i*) to irrigated and (*ii*) to unirrigated rice ; (3) to determine which is the most profitable second crop to grow after rice ; (4) to ascertain the most economical quantity of water for rice in different classes of soil, and whether light waterings at frequent intervals are not more economical for the less retentive soils than heavy waterings at longer intervals ; (5) to determine the best time to sow jute and the most profitable after-crop that can be grown in rotation with it ; (6) to ascertain the most profitable variety of ground-nut for this tract.

Raipur Farm.

Manurial and varietal experiments will be started with sugarcane, and the selection of varieties at present grown on the farm will be continued. The classification of the rices of the Provinces will be carried on in conjunction with Mr. Graham.

Demonstration.

The demonstration work will fall under the following heads :—

Irrigated rice and wheat farms.—These will be continued as last year in the more backward agricultural tracts of Chhattisgarh recently provided with irrigation from Government reservoirs. The three main objects of these farms will be (1) to introduce the system of transplanting rice and of irrigating rice and wheat and (2) to introduce the cultivation of ground-nut, jute, and the better varieties of sugarcane. The cultivation of cane will also be pushed under Government tanks in Bhandara and Chanda in conjunction with the Irrigation Department.

Cotton-seed farms.—The existing farms will be continued. Buri cotton, which was tried on these farms this year will be grown on a much larger scale next year.

The seed will be recommended to cultivators in future, more especially for lands infested with cotton wilt disease and for low-lying land where jari cotton suffers from water-logging in years of excessive rainfall. *Malvensis*, the type of jari which gives a superior lint, will be grown as a pure crop on these farms and the seed distributed.

Manures.—Co-operative experiments with nitrate of soda and sulphate of ammonia as fertilizers for cotton will be carried out by members of the Agricultural Associations in the cotton tract. The use of cattle urine as a manure, when conserved by the dry-earth system, will also be encouraged.

Prevention of smut on juar.—The method of treating juar seed with sulphate of copper to prevent smut will be demonstrated at fairs, and co-operative trials of its efficacy will be made by members of the Agricultural Associations.

Improved implements.—The use of suitable new implements will be demonstrated at the important district fairs, and new ones will continue to be tested at the experiment stations.

III.—Section under the Deputy Director of Agriculture, Northern Circle.

Hoshangabad Farm.

It was found necessary to revise many of the permanent experimental series on this farm. Some of the series have been discarded as worthless and the majority of the rest have been laid down on specially tested land. These experiments are mainly with rabi crops and include the following :—

(i) Manurial experiments on irrigated wheat.
(ii) Green soiling experiments with wheat as a dry crop.
(iii) Rotation experiments with wheat as the principal crop.
(iv) Tillage to different depths for the wheat crop.
(v) Different seed rates for wheat.
(vi) Rotation of rabi crops in embanked lands
(vii) Manurial experiments for kharif crops—

Series A, Broadcast.
Series B, Drilled.

(viii) Rotation experiments for kharif crops.
(ix) To test the most economical water-rate for wheat on black soil.
(x) Manurial experiments with calcium cyanamide and calcium nitrate with unirrigated wheat and linseed.
(xi) Manurial experiments on meadow and grass land which are the duplicates of Pusa series and experiments in laying down pastures.

Cattle-breeding Farm.

A definite programme for breeding has been laid down. Rigid attention will be paid to the rejection of young stock and the casting of old cows in the future, and every effort will be made to increase the herd by purchase of suitable breeding stock from Central India. The area of the breeding farm will probably have to be enlarged by 100 acres, as the present grazing area has been proved to be insufficient.

Damoh Demonstration Farm.

The principal object of this farm is to demonstrate the advantages of sowing kharif crops in lines in the Vindhyan districts. The farm will be continued for this purpose and improved varieties used as field crops. Green manuring of wheat is also demonstrated and the dry-earth system of conserving cattle-urine also employed. Useful implements, such as the Winnower and the Fodder Cutter, are also used on the farm to demonstrate their utility.

Wheat.

Wheat work in general will be carried out in collaboration with the Agricultural Chemist. A number of varieties will be tested for rust resistance. Some of the best tested varieties will be grown under observation on a larger scale. Selection of some of the best local varieties has already been started and will be continued on a much larger scale this year, as Agricultural Assistants from cotton seed farms will be posted temporarily to Hoshangabad in order to assist in wheat selection. Hybridization experiments will be continued and new foreign varieties tested.

The testing of varieties will be continued and the trials of the hybrids for wilt resistance will be undertaken. Selection with a view to disease resistance and earliness will be continued.

Tur (*Cajanus*).

The selection of this crop for wilt-disease resistance, quality and earliness has been started and will be continued.

Rabi Til.

Cultivation and variety tests with this crop will be continued.

Ground-nut.

This crop will be given a further trial.

Russian Flax.

A series of tests of local and English potatoes is being undertaken both at Pachmarhi and Hoshangabad, and an attempt will be made to raise new varieties from seed.

Potatoes

Demonstration plots to illustrate the improved method of sowing kharif crop in lines were laid down on malguzars' fields in three places in Saugor and Narsinghpur and have succeeded in two cases in gaining the attention and approval of neighbouring cultivators. If possible this system of demonstration by means of plots on selected agriculturists' lands will be continued next year.

Demonstration plots.

A really serviceable Winnower is gradually being evolved as new improvements are made and defects discussed and overcome. The demand for these machines is steadily growing, but there are still many parts, notably in the Satpura districts, where this machine is not known. Demonstration will be continued in selected villages and tracts this hot weather.

Implements.

The chain pump promises to be popular and will be demonstrated. An Agricultural Assistant will visit certain selected villages in representative tracts during September. He will seleet and dam a suitable nallah and fix up the machine for the purchaser.

Demonstration of the Fodder Cutter will be continued.

Trials will be given to different kinds of bullock gears, reaping machines, *kans* eradication ploughs and other machines and implements, which, if satisfactory, will also be demonstrated.

An implement depôt has been opened at Hoshangabad.

Seed farms for supplying selected cotton seed will, if possible, be started in Narsinghpur and Nimar Districts.

Cotton-seed farms.

A small demonstration farm for this purpose will, it is hoped, be started in the Jubbulpore District, but the actual establishment of more farms is hampered by the dearth of qualified Assistants to put in charge of them.

Transplantation of rice.

Six fairs will probably be attended by officers of the Department, and demonstrations of implements and seeds made, simple lectures read, and agricultural produce judged.

Agricultural fairs.

Remedial measures with regard to potato moth will be taken definitely in hand, and the best methods practically demonstrated in important centres of the potato industry.

Plant disease.

Experiments will be continued with the object of deepening and improving the wells in the trap-rock of Nimar and the Vindhyan sandstone of Damoh. Messrs. Burn & Co.'s hard percussion borer, which was found useless on the above-named formations, may probably prove successful on the Pachmarhi sandstone, a much softer rock, and experiments are being made to improve the water-supply of wells there. In Nimar and Damoh it seems probable that an expert dynamiter will have to be employed in order to deepen wells.

Well-boring experiments.

An enquiry into the best method of embanking wheat land is being undertaken, and reports on the success or failure of various Government embankments will be made.

Embanked lands.

The suitability or otherwise of local agricultural conditions for various irrigation schemes in the Nerbudda Valley will be reported on.

Irrigation schemes.

It is hoped to set up an oil-engine and pump on a well on the Hoshangabad Farm with a view to testing the economy of raising water by this means.

Oil engine.

Meetings of the various District Agricultural Associations will be attended as usual, and the home-farms of certain of the members inspected when possible.

Agricultural Associations.

It is hoped to establish Local District Sub-Agencies in one or two forward districts for the sale of implements and spare parts of machines which have been recently introduced. The Agent will buy the implements and spare parts of the machines from the Departmental Dépôt and will be allowed to make a certain amount of commission on the sale, which sum will be settled by the Local Agricultural Associations and the Department jointly.

Local agencies for the sale of implements.

Other crops receiving attention on the Hoshangabad Farm are irrigated fodder crops, sann hemp, and sugarcane.

Various.

IV.—Section under the Principal, Agricultural College, Nagpur.

Miscellaneous.—Experiments relating to crop rotation and obtainable manures and tillage operations will be continued.

Nagpur Farm.

Practical agricultural training of the College students will also be continued.

Soil moisture.—Effects of different forms of tillage and cultivation in relation to water content and movement on black cotton soil will be examined in conjunction with the Agricultural Chemist.

Soil inoculation.—Pot experiments on some typical soils of the Central Provinces and plot experiments on black cotton soil will be attempted.

Manures.—Examination of the practical utility of phosphate manures on leguminous crops in black cotton soil will be continued and enlarged.

Green manures will be treated as preparatory crops for oil-seeds.

Crops.

Juar.—A number of the juars of the Central Provinces raised in the past year on the Nagpur Farm have been selected and will be grown from produce of single heads with a view to comparison of grain yield and fodder and the future production of improved strains. Some of the better juars of other Provinces will also be tested.

Linseed.—Variations in seed rate and spacing on yield will be tested.

Sann hemp.—Effects of manures, time of sowing, harvest and seed rate will be tested.

Fodder crops.—Efforts will be begun to compare crops available for fodder purposes in order to find which are most profitable under local conditions of soil and climate.

Stock.—Experiments will be tried in the feeding of farm stock both in coarse fodder and concentrated cakes with a view to arriving at the most satisfactory diet with regard to economy.

Agricultural Education.—The students, who have increased in number since the last time of report, will require a considerable amount of time from the experts, as the assistant staff is still inadequate. The Principal will be engaged in the management of the same and in the management of the Local Technical Museum.

V.—Programme of Work of the Economic Botanist, Central Provinces, for 1909-10.

The principal work to be undertaken by the Economic Botanist is the study of the varieties of juar (sorghum) and of rice grown in the Provinces. Some progress has been made with the work and a large number of varieties are growing for classification purposes on the Telinkheri and Nagpur farms.

Sann hemp will continue to be grown in order to test the value of certain distinguishing characters.

A collection of Indian cottons is being grown on the Nagpur Farm.

Investigations on other rabi and kharif crops with a view to determination of varieties and of improvement.

A collection of plants illustrating the principal natural orders and a collection of economic plants is being made near the Maharaj Bagh.

VI.—Programme of Work of the Agricultural Chemist, Central Provinces, for 1909-10.

The following lines of work will be carried on in addition to the educational work in the College :—

General analytical work for the Department and in connection with questions put forward by the Local Administration.

Continuation of a study of the composition of the wheats of the Central Provinces in conjunction with Mr. Evans, Deputy Director, Northern Circle. Particular attention will be paid this year to those wheats largely in demand for the export trade.

Analytical work in connection with sugarcane selection on the Raipur Farm, in collaboration with Mr. Clouston, Deputy Director, Southern Circle, will be continued.

Information concerning the soils of the Central Provinces and Berar will also continue to be collected, special attention being paid this year to the sugarcane tracts of the Chanda district.

VII.—Entomology.

The Assistant Entomologist will devote all his attention to out-door work. He will pay special attention to the cultivation of *bhendi* as a catch crop for boll-worm in cotton.

VIII.—Publications.

The *Agricultural Gazette*, published monthly, will be continued. An endeavour will be made to make it still more popular by illustrating its articles where possible.

IX.—Agricultural Associations.

The meetings of the Agricultural Associations will be attended by officers of the Department as formerly.

Referring to the manurial experiments on cotton the Committee recommends *that manurial experiments in general should be confined to the trial of fertilisers* which are available or are likely to be available in India at remunerative prices. *The Programme is approved.*

Mr. Hemingway replying to the President said that Mr. Clouston's method of growing gram and cotton in alternate lines appeared likely to prove valuable, and had been tried by cultivators on their own initiative with good results. Mr. Clouston having explained the aims of the work on manures and on varieties of grass suitable for black cotton soil, was questioned by the President as to the introduction of Buri cotton, and replied that this variety appeared far more resistant to wilt than jari and that its introduction might lead to great reduction of loss from the disease. Dr. Butler fully endorsed Mr. Clouston's views on this point and emphasized the value of the work in this direction. Considerable discussion took place on the question of implement-depôts, in the course of which Mr. Keatinge referred to difficulties in dealing with trade agencies ; Mr. Renouf was of opinion that these difficulties were due to the low price at which the Departments supplied implements making it not worth while for trade agencies to take up orders, and Mr. Milligan mentioned that to meet this difficulty implements in the Punjab were supplied at 10 per cent. above cost price, which guarded the Department from loss on incidental expenses and would enable a trade agency to make a fair profit. Mr. Hemingway referred to the danger of unscrupulous firms injuring the reputation of the Department by supplying inferior implements, and Mr. Burt said that the United Provinces Department were proposing to employ a firm who would supply only certain approved types of implements. Mr. Clouston was of opinion that the Department should be merely advisory ; simple implements might be manufactured at the various farms. Mr. Sampson drew attention to the ingenuity of the village blacksmiths of Madras in manufacturing implements of a simple type.

The Board finally resolved that the subject should be brought up for separate discussion at the next meeting.

The Board accepts the Central Provinces Programme.

BURMA.

General.

1. The scheme for the development of the Agricultural Department in Burma contemplates three principal Agricultural Stations :

(1) The Mandalay or College Station : the objects of which are demonstration and the training of students : experimental work on irrigated crops of irrigation districts and the dry crops of those districts which depend merely on the natural rainfall : and the production and distribution of selected seed when proved varieties are obtained.

(2) The Hmawbi Agricultural Station, in the rice growing tract of Lower Burma : for varietal cultivation, rotation and manurial experiments on paddy : experiments with new crops such as jute : attempts at winter cultivation after paddy : and a small area under fruit cultivation. A large area is here also available for seed production and for fodder production for the farm cattle. This farm was not financed last year, and it is not yet known whether funds will be available this year.

(3) The Meiktila Agricultural Station, in the dry zone of Upper Burma : for varietal, rotation and selection experiments on the dry land crops of Upper Burma : the study of drought resisting crops and, when found, the production and distribution of selected seed. Experiments in sheep breeding will also probably be initiated here. This station has not yet been acquired, but the land has been selected. The introduction of crops new to the tracts, which can be profitably grown, and the improvement by selection of indigenous crops, will form a principal part of the work at each station.

2. The following are the chief lines of work proposed during 1909 :—

Paddy.

(1) *Paddy.*—At Mandalay experiments with natural available manures, *e.g.*, paddy husk, burnt and unburnt, paddy straw, burnt or ploughed in immediately after reaping or at the beginning of the monsoon : wood ashes : street sweepings, etc. Experiments are also being made with the principal artificial manures, the object aimed at being the minimum economical rate. Special efforts will be made to popularise bone meal so as to stop the present export of bones. Green-manuring with indigo and *Crotalaria juncea* will also be tried. Rotation experiments will be started and, probably, in association with the Irrigation Department, irrigation experiments. Cultivation experiments—principally in the rate of seedlings planted together—will also be continued.

The varietal classification of the Upper Burma paddies which has now been in progress for two seasons will be continued : and a commencement will be made with Lower Burma varieties at Hmawbi. In Lower Burma, however, varieties are so numerous that only a few districts can be taken up at a time.

Wheat.

(2) *Wheat.*—Classification of the indigenous varieties and trials of introduced varieties. A scheme of manurial, rotation and cultivation experiments has also been drawn up.

Cotton.

(3) *Cotton.*—A continuation of experiments with Egyptian cotton which gives fair promise of success, to ascertain the correct time for planting in Burma. This will be arrived at by monthly sowings.

Selection and crossing of indigenous varieties will be attempted. Cultivation and rotation experiments will also be instituted and experiments will be tried at Hmawbi with the Pernambuco tree cotton of Amherst.

Ground-nut.

(4) *Ground-nuts.*—The soil of the Mandalay farm is somewhat too heavy for this crop, but their cultivation will be continued. A number of exotic varieties, *e.g.*, Mauritius, Virginian and Rufisque—have succeeded, and it is desirable to maintain these varieties at Mandalay till the Meiktila farm is opened. In view of the enormous development of this crop in Burma a close study of all available varieties is being made and experiments to ascertain the relative yield and percentage of oil as also the power of resistance to disease are in progress.

Miscellaneous crops.

3. The above are the main lines of work which have been started. Of subsidiary crops, jute gives fair promise of growing well. Its cultivation will be continued and the commercial value of the crop estimated; the crop being grown on a sufficient scale to allow of a Profit and Loss Account being kept. *Jowar* and *maize* are, at present, grown mainly for fodder; but a study of the indigenous races is contemplated and, with the comparative cultivation of exotic races, may be initiated next year. It is also hoped to set up cultivation plots of all the various peas and beans grown in Burma so as to settle the botanical classification and the food value.

Hmawbi Station.

4. The above notes refer principally to the Mandalay Station which, it is hoped, will soon be completely laid out and have a permanent cropping scheme. At the Hmawbi Station, if funds are available, the greater part of the first year's work must necessarily be the laying out of the land into convenient plots for experiments. The area chosen for manurial and other experiments, in which yield results have to be taken, must also be standardized. It is improbable therefore that anything more will be possible this year than a few varietal experiments with paddy for purposes of classification and, perhaps, a small series of experiments in winter cropping after paddy.

Utilisation of sewage, night soil, etc.

5. I am at present, in consultation with the Sanitary Commissioner, working out a scheme for the utilisation, for agricultural purposes, of the sewage and night-soil of Municipalities and Towns.

Fruit Experiments.

6. At the Katha Garden, which has been brought under the direct control of the Principal of the Agricultural College, the old trees which give no promise, will be weeded out and the whole place restocked. At Mandalay the Agricultural Botanist will have an area assigned to him for fruit experiments. At Hmawbi there is also area suitable for this purpose. The objects at all places will be the improvement of indigenous fruits by selection and grafting: and the introduction of better varieties of exotics. Demonstrations in grafting and pruning will, in due course, be given to interested parties.

The Agricultural Chemist.

7. The work of the Agricultural Chemist will comprise—

(*a*) A chemical analysis of the soils of the Mandalay and Hmawbi Agricultural Stations.

(*b*) A continuation of the work on silt deposits on the lines of Sir Edward Buck's Report.

(*c*) The preliminary examination of a few important varieties of paddy. This enquiry will include the composition of various varieties and the determination of the inorganic matter and nitrogen absorbed by them during growth.

(*d*) Soil analysis for Settlement Officers.

(*e*) Examination of sessamum and ground-nut oils and toddy-palm juice.

Agricultural Botany, Entomology, Mycology.

8. The Agricultural Botanist on his arrival will be engaged in acquiring a knowledge of Burmese crops and plants. He will then take over the botanical surveys of indigenous paddy, cotton and wheat

which are at present in the hands of the Assistant Botanist. The Entomological Assistant will pursue his investigations into the insect pests of cotton and will continue his collection of insects of economic importance. Mycological questions will be dealt with by the Botanist as they arise.

9. A scheme for the establishment of a Central Depôt for the supply of improved implements is under consideration. Various implements, demonstrated at the Mandalay Station, are in considerable demand.

Improved Implements.

10. It is hoped to start the Three-Years' Course in June 1909. The curriculum has been drawn up in accordance with the standard syllabus of the Board of Agriculture. Until a subordinate teaching staff has been trained no other courses of instruction will be attempted, but a draft calendar, indicating the courses of instruction which will ultimately be given, has been framed. The staff are busily engaged on the compilation of material for Agricultural Text-Books.

Agricultural Education.

11. The issue of leaflets and bulletins, as required, will be continued. The former have already met with an altogether unexpected measure of success. As a rule they are published in English, Burmese, Karen and Shan.

Publications.

The desirability of issuing a monthly Agricultural Journal is also under consideration.

12. In the event of funds not being available for Hmawbi, the Deputy Director will continue the Agricultural Survey of districts in Upper and Lower Burma. Myingyan has been completed and the result is a conspectus of the Agricultural requirements of the district which renders advice on matters referred exceedingly simple. All members of the staff will assist in this as occasion offers.

Agricultural Survey.

J. MACKENNA,

Director of Agriculture, Burma.

The Committee learns with regret that, in consequence of financial pressure, the European Staff may have to be reduced and the Programme curtailed in proportion. The Director informs the Committee that, in view of the backwardness of general education in Burma, it has been decided not to establish an Agricultural College at present. Attention will be concentrated on the training of Field Assistants.

Mr. MacKenna spoke on the decimation of the Department due to the incidence of the period of severe financial stress through which Burma was at present passing. In view of the fact that the Department was in danger of losing the services of Mr. Thompstone, while the Economic Botanist was still at Pusa, he suggested that the Programme should not be discussed in detail. To this the Board agreed.

The Board accepts the Burma Programme.

EASTERN BENGAL AND ASSAM.

There are seven Agricultural Stations in the Province, *viz.*, Dacca, Rajshahi, Burrhat (Rangpur), Jorhat, Shillong, Upper Shillong and Wahjain. The superior staff at present consists of the Assistant Director, Agricultural Chemist, Fibre Expert and an Agricultural Supervisor. Mr. Finlow, the Fibre Expert, still has his head-quarters at Pusa. Mr. J. N. Chakravarti, Agricultural Supervisor, is also at Pusa undergoing a year's special training under the Imperial Agriculturist. Mr. Birt, Officiating Assistant Director, and Mr. Meggitt, Agricultural Chemist, have their head-quarters at Dacca. All work has hitherto been greatly hampered by the delay in completion of the laboratory building and officers' residences at Dacca, but there is now good hope that most of the buildings will be ready for occupation by the beginning of the next cold weather. On the completion of his training at Pusa in June next it is proposed to place Mr. Chakravarti in charge of the Dacca

Farm. Probably a second Supervisor will shortly be recruited and deputed to Pusa for training. Proposals have also been submitted to Government for the appointment of a separate Deputy Director and it is hoped that an Economic Botanist will shortly join the Department.

The following are the chief lines of work it is proposed to undertake next year on the Agricultural Stations :—

(1) *Sugarcane.*—The scheme of sugarcane experiments has been remodelled with a view to (*a*) the existing soil conditions of the farms, (*b*) the limited resources of local rayats. It is considered that heavy doses of oil-cake and other expensive manures are not within the means of ordinary rayats and prejudice whatever good results may be obtained on the farms. At Rajshahi and Jorhat it is therefore proposed to experiment with a view to find the best cane for local conditions with the manurial treatment most generally in vogue in the neighbourhood. When we have arrived at a decision as to the best variety, its superiority will be demonstrated on rayats' fields and its possibilities further tested by an experiment on a commercial scale on the farm. Having induced the rayats to accept the superior variety of cane we shall then endeavour to make a further advance by first ascertaining and then introducing the most profitable form of manuring.

(2) *Jute.*—At Rajshahi an experiment will be made to ascertain the residual effect of manures. The series of plots used for the manurial experiments of 1908 will be used for this purpose, uniform treatment being given to each. The two-year rotation experiment will be continued. It consists of jute-potatoes, jute-pulse with only one manuring (to the potatoes) during the rotation. A third experiment having relation to the value in the soil of organic matter is being carried out with jute refuse. At Dacca an area of about 3 acres is to be cultivated with jute followed by paddy. The main object at present is to test and promote the evenness of the land.

Mr. Finlow has submitted a separate programme which is printed as an annexure.

(3) *Rice.*—The manurial and variety experiments commenced at Dacca in 1908 will be continued with some additions. The chief object of the manurial experiments is to ascertain the effect of green manuring with sunn-hemp and dhaincha as compared with cowdung, oil-cake and mineral manures. Most of these experiments will be duplicated at Rajshahi, where the paddy land is of a different type. The Economic Botanist will be asked to take up a general investigation of the varieties of rice with a view to selection and breeding experiments. A certain amount of selection was done with last year's crop by the farm staff.

(4) *Potatoes.*—The experiments at Shillong include—

(1) Trials of different varieties,

(2) Manurial experiments,

(3) Spraying with Bordeaux mixture,

(4) Cut sets against whole sets,

(5) Sprouting before planting,

(6) Mulching the winter crop.

Efforts are being made to popularize the cultivation of Naini Tal and Darjiling potatoes in the plains. Demonstrations will be continued at all the farms and it is proposed to make a special experiment in growing potatoes at Haflong, in the North Cachar Hills, whence with low railway freights seed of the best kinds can be distributed at a low cost to cultivators in the plains.

(5) *Tobacco.*—The previous experiments with exotic tobaccos will be continued on a small scale, and as there is some fear that the farm seed may have been cross fertilised, fresh seed of each variety will be

imported and sown on duplicate plots. The main crop of the year will, however, consist of one acre of Sumatra and one acre of the local Bhengi variety, to be grown for special experiments in regard to after treatment, with the object of producing tobaccos suitable respectively for cigars and cheap cigarettes.

(6) *Ground-nut.*—Ground-nut was tried in 1908 and gave good results at all farms. The experiments will be repeated next year on a commercial scale with a view to the introduction of this crop into the Province. No sign of disease appeared anywhere last year, with the doubtful exception of Rangpur.

(7) *Lemon-grass oil.*—The experiments with lemon-grass will be continued at Wahjain, where all the oil distilled has yielded a handsome profit. The experiments are also being duplicated at Shillong.

(8) *General.*—Most of the soil of the Dacca farm is so uneven in character that for some time it will not be fit for experimental work. At present efforts are being made to level up and standardize the land by green manuring and cultivating it uniformly in large blocks. Similar conditions prevail on portions of the other farms and the cropping schemes have been arranged accordingly.

(9) *Demonstrations.*—It is proposed to continue the demonstrations made in 1908 in (1) spraying of potatoes and (2) manuring rice with bone meal and saltpetre, on rayats' fields in the neighbourhood of Shillong. Demonstrators trained on the farm will also be sent out to two new centres in the Khasi Hills. The Superintendents of the other farms will also during 1909 carry out at least one demonstration each on a rayat's field. Arrangements are being made to start classes for training suitable youths from the village schools of the Khasi Hills. They will be given a vacation course, with about two hours work a day, for three separate periods of a month each, during which they will receive practical training in the grafting, budding and pruning of fruit trees. The Associates of the Department will also make demonstrations as in previous years and it is expected that with the strengthening of the staff we shall be able to give them more attention than has hitherto been possible.

(10) *Cattle-breeding.*—It has been decided to restrict the breeding work at Upper Shillong to the production of young Patna bulls for distribution in the district. Two new bulls and a cow have recently been added to the herd.

(11) *Sericulture.*—Mr. M. M. Chakravarti, who has recently been confirmed as Superintendent of Sericulture, is commencing the construction of houses and cultivation of mulberry land on the site acquired for a central grainerie at Mirganj. The chief object of his work will be to produce and sell on business lines the largest possible quantity of guaranteed seed. Efforts are being made to improve the training provided for young rearers at Rajshahi Sericultural School. The experiments at Shillong have shown that in that locality the seed of the European silkworm can be carried over at least two generations without deterioration. These experiments will be continued; but as the results already obtained are sufficiently conclusive, our future work will be directed almost entirely to popularizing silkworm rearing among the Khasis. During 1908 several acres of mulberry were planted out on private fields. The distribution of mulberry cuttings from the farm at a low price will be continued and rayats will be given instruction and help in planting, constructing houses and rearing. A second Khasi boy has just been sent with a stipend to learn sericulture at the Rajshahi School.

S. G. HART,
Director of Agriculture,
Eastern Bengal and Assam

ANNEXURE.

PROGRAMME OF THE FIBRE EXPERT

(*a*) Continuation of the study of the races of jute in collaboration with Mr. Burkill, the object being to investigate the possibility of improving the jute crop by raising and distributing improved seed.

(*b*) Continuation of experiments in Eastern Bengal and Assam and in other parts of India in connection with the scheme for the extension of jute cultivation to tracts where it is not at present grown on a commercial scale.

(*c*) Experimental cultivation of flax, including the investigation of the supposed deterioration of the crop when grown continuously in the plains and the possibility of utilising the cooler portions of India such as Assam or Kashmir for the raising of good seed.

Experimental cultivation of other fibre crops, such as Sida (several varieties), *Urena lobata*, *Triumfetta neglecta*, *Asclepias semilunata*, having regard for their agricultural possibilities as well as the intrinsic merit of their respective fibres.

(*d*) Study of the retting of jute, sunn-hemp and other fibres from the chemical and the bacteriological point of view.

(*e*) Continuation of investigation into the cause and possible prevention of "Heart Damage" which sometimes takes place in jute after baling, rendering it unfit for spinning purposes.

(*f*) Investigation into the possibility of introducing simple machines with the object of (*a*) lessening the large amount of labour and (*b*) reducing the large volume of water at present necessary for the retting of jute and similar fibres. A considerable extension of fibre cultivation in some tracts depends on the removal of one or other of these obstacles.

(*g*) As opportunities occur observations are being made regarding the sources of material for paper making.

The Programme is approved subject to the remark that the work undertaken should not be in excess of the capacity of the small European Staff.

The Committee notes that the soil of the Dacca Farm is reported to be very uneven in character, but the Provincial Department is of course fully alive to this defect.

The Committee understands that under the present sanctioned scheme, there will be no European Deputy Director and it considers that the appointment of at least one European Deputy Director is essential, at all events in the early stages of the development of the Department.

The delay in completing the laboratory and other necessary buildings has hampered the Department in its work.

In answer to enquiries from Mr. Sampson as to the scope of the work on rice, Mr. Hart said that at present experiments would be confined to manurial and varietal tests.

The Board accepts the Eastern Bengal and Assam Programme.

BENGAL.

1. There are at present six main farms in this Province, *viz.*, Burdwan, Bankipore, Dumraon (Shahabad), Sabaur (Bhagalpur), Cuttack and Chinsura. Four of these are Agricultural Stations ; Burdwan and Dumraon are small farms belonging respectively to the Burdwan and Dumraon Raj Estates, worked by the Department.

Particulars regarding the physical and climatic conditions are given in the statement below :—

Serial No.	Name of Station.	Situation.		Tract represented.	Area in acres.	Type of soils.	Date when established.	Height above sea level.	Average rainfall in inches.	Temperature.	
		North Latitude.	East Longitude.							Maximum.	Minimum.
								Feet.			
1	Burdwan	23°70′	88°00′	Burdwan	31	Sandy alluvium	1885	99	57·54	89°	70°
2	Dumraon (Shahabad)	25°30′	84°00′	Shahabad	30	Sandy loam	1895	239	41·13	88°	68°
3	Bankipore	25°30′	85°14′	Patna	210	Heavy clay	1906	183	44·54	88°	69°
4	Sabaur (Bhagalpur)	25°12′	87°1′	Bhagalpur	324	Sandy	1908	160	49·35	87°	68°
5	Cuttack	20°29′	87°54′	Orissa Delta	60	Sandy	1904	80	60·35	90°	73°
6	Chinsura	22°53′	88°27′	Lower Bengal Delta.	210	Clay	1908	38	..	..	..

In addition there are the following small farms : Chaibassa Tassar Silk Farm of 50 acres in Singhbhum, the Kalimpong Demonstration Farm of 50 acres in the Darjeeling hills and the Fraserganj Demonstration Farm of 75 acres in the Sunderbands.

2. On the Government Agricultural Stations the following lines of work are being carried out.

Paddy is under experiment at Burdwan and Cuttack and is being grown for seed distribution at Bankipore. At Burdwan both qualitative and quantitative manurial experiments are in progress, varieties of paddy are under selection, experiments are being made on the number of seedlings required per hole, rotation with jute and on the utility of different seed rates in broadcast sowing and in spacing the transplanted plants. At Cuttack similar experiments are in progress with the addition of experiments on the comparative value of various farm implements and different methods of irrigation.

3. *Jute* is under experiment at Burdwan and Cuttack and will be selected for seed at Chinsurah. At Burdwan manurial experiments are in progress, and an enquiry is being made into the value of the fibre obtained from plants cut at different stages. Variety experiments are also being undertaken and in accordance with the general scheme of experiments on cultivation, investigations are in progress on the spacing of the plants and on methods of sowing and on rotation with paddy and potatoes.

At Cuttack similar experiments are in progress.

4. *Other crops.*—The manure, variety, planting and rotation experiments on sugarcane at Dumraon and the variety experiments at Bankipore and Cuttack will be continued, and the variety experiment on mustard will also be continued at Dumraon. Manurial and variety experiments on potatoes are in progress at Burdwan and Cuttack. Ground-nuts and turmeric are being experimented with at Cuttack. Cotton is under experiment at Chaibassa, where manurial and selection experiments on the *buri* variety are in progress. Juar, maize, gram, wheat and barley are under observation at Bankipore.

5. The seed distribution work is being continued and selected varieties of most of the important crops of Bengal are being grown at all the experiment stations for distribution.

6. *Tassar silk.*—At the Chaibassa Tassar Silk Farm the distribution of one year acclimatized cocoons for seed purposes will be continued.

7. *The Silk Committee's programme.*—The supply of silkworm seed—*deshi* and *nistri*—to cultivators from the Government nurseries at cost-price will be continued. There are at present seven seed-rearing nurseries, and during the year six more will be opened. Training of rearers' sons and nurserymen will be continued.

8. *General.*—At Kalimpong information on the crops and agricultural practice of the Darjeeling hills will be obtained and at Frasergunj the work on reclamation of salt soils will be continued. Well-boring experiments will be undertaken and cattle-breeding at Pusa and Sripur will be continued.

Programme of Principal.

9. *College.*—It is not anticipated that the College will be opened during the current year and the work in connection with it will be light.

10. *Sabaur Farm.*—The work of the farm is at present crippled for want of water : its equipment with the means of irrigation will be pushed on and the farm will be divided into specific areas for College grounds, general work, comparative experiments and special investigations. Areas will also be required later for students' cultivation and for demonstration. The determination of the local variation in fertility for a cereal and a pulse crop in rotation of a large open area, destined for comparative experiments, will be begun during the present year and will, it is hoped, be completed in 1911. The general farm staff and the greater part of the land will be conservatively utilized for ordinary farm work, thus enabling the Superintendent to carry out efficiently the routine work of the growth of any crops for any purposes required by any officer of the Department at relatively short notice.

11. *Tour.*—The principal and representative parts of the Province will be visited during the seasons most important to agriculture.

Programme of the Economic Botanist for 1909.

12. Administrative work will probably take up most of the time of the Economic Botanist during the year and will include the organisation and planting of the botanical areas and the laying out of the College grounds, together with the supervision of the botanical fittings of the College. In preparation for the botanical teaching the work of collecting teaching-specimens will be continued.

13. On the scientific side, the collection and study in the field of the flora of Bengal and the collection of the seeds of the economic plants will be continued, as well as the work on mangoes, fibre plants and the cucurbits of Bengal.

14. Arrangements have also been made for commencing work in co-operation with the Agricultural Chemist on the varieties of sugarcane to be found in Bengal and also for selection work on farm crops. It is also hoped that it will be possible to commence a botanical investigation of the effect of the number of paddy seedlings used per hole in transplanting on the yield and tillering of paddy.

15. The commencement of the seed testing will have to be postponed until the College is opened for scientific work, as at present the accommodation is extremely limited and the staff inadequate.

Programme of the Agricultural Chemist.

16. Most of the time of the Agricultural Chemist is at present being taken up by the organisation and fitting of a laboratory at Sabaur and by the training of an assistant. There is a considerable amount of routine work being done in connection with the various Government farms all over the Province, and work is also being done for private individuals who are interested in agriculture.

17. A commencement is being made with the co-operation of the Economic Botanist in the work of classifying the different types of sugarcane now existing in this Province. The part of the work undertaken by the Chemist will be as follows :—

(*a*) Determination of rates of ripening in the different varieties.

(*b*) Estimation of sucrose content and general determinations of the chemical characters of the cane.

(*c*) Experiments on chemical selection of the canes.

18. Among the chemical general problems involved in the agriculture of Bengal it is intended to commence a study of the nitrifying power of different typical Bengal soils.

W. R. GOURLAY,

Director of Agriculture, Bengal.

The Board accepts the Bengal Programme.

KASHMIR.

I. Experimental work at the Pratap Model Farm to be continued on the following points :—

(i) *Varietal Experiments.*—Varietal experiments with wheat, oats, mustard, paddy, maize, tobacco and ground-nuts will be continued as last year, and in the case of mustard, paddy and ground-nuts which have given good results so far, trials will be made on a larger scale.

(ii) *Cultivation experiments on paddy crop.*—Different methods of cultivation as to sowing and planting now in general use all over the Valley will be compared.

(iii) *Manurial Experiments.*—Manurial experiments with wheat, mustard and oats will be continued. The manures to be tried in each case are those which are easily obtainable by the cultivators of the Valley. Leguminous crops are being tried as a green manuring for wheat and paddy as last year in comparison with Farm Yard manure. The object is to see whether green manuring could quite as well and economically serve the purpose of Farm Yard manure which is very difficult to get sometimes at any price.

(iv) *Rotations.*—The experiments with Norfolk rotation of four course system, *two-year* rotations and *Dofasli* rotations will continue on the same lines as last year.

(v) *Miscellaneous crops.*—Trial of the following crops will continue : Juar, Bajri, Lucerne Mangels, etc. Fibre experiments with Jute, Sunn hemp and Russian linseed on a small scale, which gave some encouragement last year, will be tried on a large scale.

(vi) *Improved Agricultural implements.*—The suitable new implements will be introduced and their use demonstrated at fairs. The implements under trial on the Pratap Model Farm are given below :—

(*a*) Winower.	(*g*) Flax breaker.
(*b*) R. Hunt Kibbler.	(*h*) Flax Scutcher.
(*c*) Chaff Cutter.	(*i*) Watts' chain plough.
(*d*) Maize huller.	(*j*) Meston plough.
(*e*) Hand Maize Sheller.	(*k*) Karab (Levelling instrument).
(*f*) Cotton gin.	(*l*) Kashmiri plough.

The trials with these implements will continue for another year before deciding as to which of these can profitably be introduced among the cultivators.

II. Seed selection and distribution of ordinary crops will continue.

III. *Cattle-breeding.*—Efforts will continue to improve local breeds of cattle by the distribution of stock from the Farm.

IV. *Agricultural Show.*—A Live Stock and Agricultural Show, which was held at Srinagar during the second week of October 1908, met with a considerable success. It has been decided that one Show on a larger scale will be held every year in future.

V. The organisation work of the Department as well as the proposed Seed Farm await the sanction of the higher authorities.

VI. Introduction of European fruits and vegetables in the State Gardens will continue.

L. C. SHARMA,
Director of Agriculture, Kashmir State.

In answer to enquiries as to the staff at his disposal, Mr. Sharma said he had three assistants ; one more had been promised by the State and three students were to be sent to Pusa for training.

The Board accepts the Kashmir Programme.

BARODA.

There are four Farms in the State. Baroda and Kadi Farms serve as demonstration stations and as central depôts from which seeds, good bulls and improved machinery can be obtained. Songhad and Vyara Farms are newly established for the purpose of introducing Sericulture in the country. The experimental work on which the Department will be engaged during the year 1909-10 will fall under the following heads :—

1. Tobacco experiments :—
   (1) Manure.
   (2) Variety.
2. Paddy experiments :—
   (1) Variety.
   (2) Cultivation.
      (*a*) sowing broadcast ;
      (*b*) transplanting.
3. Cotton :—A number of new varieties have been introduced, and are being tested. Indigenous varieties will be selected, and endeavours to improve them will be made.
4. Potatoes :—
   (1) Manure experiments.
   (2) Variety experiment.
5. Ground-nuts :—
   (1) Manure experiments.
   (2) Variety experiments.
   (3) Distribution of tested varieties.
6. Sugarcane :—
   (1) Manure experiments.
   (2) Trials of new varieties, and introduction of better methods of crushing and gur-making into the chief Sugarcane districts of the State.
7. Jowari and Maize :—Trials of new varieties and selection of indigenous varieties.
8. Wheat :—
   (1) Manure experiments.
   (2) Variety experiments.
9. Implements :—Suitable foreign and native implements are being introduced. Simple and inexpensive implements are being made locally. This work will be continued.
10. A complete agricultural survey is about to be commenced.
11. Publication of cultivators' leaflets and a quarterly magazine will be continued.
12. Insect and fungoid diseases will be noted and specimens collected and forwarded for examination and identification.
13. Sericulture is being pushed.
14. Cattle-breeding :—Efforts are being made to introduce good milking strain of cattle and to improve local breed by crossing it with half English Gujrat bull. The Baroda Model Farm will continue to distribute young bulls of its own breeding to cattle breeders in the district.

M. A. SITOLE,
Director of Agriculture,
Baroda State

The Board accepts the Baroda Programme.

MYSORE.

The following outline of work as far as work on the Experimental Farm is concerned largely reproduces the programme laid down by Dr. Lehmann before his retirement in September last.

The following experiments on the Experimental Farm are being begun :—

(a) *With Sugarcane*—

(1) To study the effect of the season of the year on the growth of sugarcane by planting sugarcane every six weeks throughout the year. This is with a view to obtaining data for the most economic use of improved sugar machinery.

(2) The rotation of sugarcane with leguminous crops, those chosen being *chenna* and ground-nut.

(3) Variety experiments.

(b) *With Paddy.*—

(1) Manurial experiments with paddy including green manuring.

(2) To study the effect of ploughing the land as dry land and as soon as possible after the crop is reaped compared with the general method of leaving the land untouched until shortly before planting and then ploughing it "in puddle."

(3) Transplanting paddy as compared with broadcast sowing.

(4) Sowing sprouted seeds dry as compared with sowing them in puddle.

(5) Deep cultivation as compared with ordinary shallow cultivation.

(c) *With Ragi*—

(1) Studying the effect of growing ragi together with other crops as generally practised in Mysore as compared with the system of rotation as practised in Europe and America. The latter facilitates harvesting with machinery.

(2) Experiments with green manures.

(3) Seasonal experiments with ragi, the sowing operations to extend through the months of April to August.

II. Chemical Laboratory.

PROGRAMME PREPARED BY MR. A. K. YEGNANARAYANA IYER, M.A., ASSISTANT CHEMIST.

(1) Study of the soils of Mysore.

(2) Study of the extent of soil enrichment in Nitrogen by the growing of legumes.

(3) Study of the rate of nitrification of bone meal, castor cake, blood manure in the soil.

(4) Study of the soil moisture in land treated according to the Campbell method of dry farming as well as the comparison of soil, with other mulches.

(5) Analyses of the various green manures used in Mysore as well as the leguminous green crops forming part of the green manure experiments in the Farm.

(6) Testing of the country methods of seed preservation and the effect of preservatives on germination.

(7) Miscellaneous analyses of fertilisers, soils and sugar and other agricultural products.

III. Mycological and Entomological Investigations.

(i) *Mycological*—

(1) A continuation of the investigation of Koleroga of areca-nut especially with a view to combating the disease.

(2) *Further investigation of a root disease of areca-nut known locally as "Anaberoga" and due to a species of Polyporus.*

(3) *A continuation of experiments on the ring disease of potatoes with a view to ascertaining the most important means of transmission of the disease. In this connection an attempt will be made to introduce* better and more resistant varieties of potatoes.

(4) The preliminary survey of the fungous diseases of the State already begun will be continued.

(5) The investigation of the Spike disease of the Sandal will be begun.

(6) The Herbarium collection which has been started will as far as time permits be augmented.

(7) The nitrifying bacteria of the soil as well as the nitrogen fixing forms are being studied.

(ii) *Entomological*—

(1) The preliminary survey and investigation into the insect pests of agricultural crops which has already been, in a small way, begun will be continued.

(2) Special attention will be paid to certain species of hairy caterpillars as well as to certain grasshoppers which periodically do considerable damage to crops.

(3) As much attention as possible will be paid to augmenting the small collection of insects already made.

LESLIE C. COLEMAN, M.A., PH.D.,
Mycologist and Entomologist in charge of the Agricultural Chemist's Office.

The Committee is of opinion that the Programme is a good one, but that a full Agricultural Staff with a European training is essential to bring it to a successful issue.

The Board accepts the Mysore Programme.

It was resolved that the nature of the Programme submitted annually to the Board should be considered by a Committee of the Board in 1910.

As regards a letter from Mr. Burkill on the subject of co-operation between Provinces, the Committee is of the opinion that there is no unnecessary duplication in the programmes under consideration, and that the present arrangements, under which progress reports are published annually and members of the Department are afforded frequent opportunities of consultation at the Board Meetings, are calculated to ensure that the experience gained in all Provinces is fully utilised and that the maximum of co-ordination is attained. If anything extra were required, it would be in the provision in special cases of facilities for visits to experimental work in other districts.

SUBJECT IV.—THE BEST MEANS OF BRINGING THE RESULTS OF EXPERIMENTAL WORK IN AGRICULTURE TO THE NOTICE OF CULTIVATORS.

The President of the Board welcomed the Honourable the Chief Commissioner of the Central Provinces to the Meeting. The report of Committee (*c*) was then considered.

The President opened the discussion by expressing his sense of the great importance and utility of the information condensed into the Report now laid before the Board, summarising as it did the experience of many years, and his conviction that it would in the future prove an extremely valuable guide, in particular, but by no means exclusively, to the younger officers of the Department.

Dr. Mann, in the course of a long speech on the general principles which should be kept in view by those who wish to win the confidence of the *ryot*, laid stress on the importance of personality, accurate knowledge of local conditions and the

introduction only of such new methods as would really pay a profit after taking account of increased initial outlay; the cheapening of capital by means of Agricultural Banks was an extremely important factor in agricultural improvement. He advocated concentration on small areas and on problems of a restricted and definite nature.

Mr. Clouston regarded demonstration work as being the most important line in the Central Provinces. He referred to the possible utility of orphanages as sources of supply of boys who could be trained for the Department, and was strongly of opinion that to really reach the cultivator, it was necessary to have a man who had been born a cultivator or who had been from his youth accustomed to mix with cultivators, rather than one of the higher class of agriculturally-trained Science graduates.

Mr. Moreland was in general agreement with the views of the Committee. The outlook on life of cultivators of separate communities, even in districts not far removed from one another, was often so fundamentally different that no cut and dried schemes were possible. Know the people, know what they want, and don't worry them.

Mr. Keatinge, referring to the formation of Agricultural Associations pointed out that this was likely to prevent the concentration advocated by Dr. Mann, since the available staff was insufficient simultaneously to concentrate and properly attend to such Associations. Alluding to Mr. Clouston's remarks as to the inadvisability of appointing Hindus of the higher castes to the Department because they were unlikely to be in sympathy with the cultivator, he pointed out that there was a large class of cultivating Brahmins in the Bombay Presidency, the Anavla Brahmins of Gujarat.

Mr. Evans agreed with Mr. Keatinge as to the difficulties introduced by the sudden formation of Associations which were, in certain instances, unreliable as sources of information.

Mr. Sampson advocated introducing improvements in the more advanced districts to begin with, since there the intelligence of the cultivators would lead to their more speedy adoption.

Mr. Hemingway, from experience in the Central Provinces, suggested the opposite method, since the more backward a district the greater by contrast would be the effect of any improvements which were introduced.

In accordance with the views expressed by Messrs. Sampson, Hart, Couchman and Howard, the Board resolved that in future years instead of rewriting the report the new information gained should be embodied in an appendix, the material for which, consisting of the actual results obtained on the lines of the report, should be submitted by Provincial Departments to the Inspector General three months before the Meeting of the Board.

The Honourable the Chief Commissioner of the Central Provinces, in an extremely lucid and interesting speech, reminded those present that the subject of the Report under consideration was the one object on which every effort of the Department should be concentrated.

Alluding to the comparative youth of the Department, he mentioned that so long as ten years ago there had existed in the Central Provinces an Experimental Farm, which had prepared the ground for the second most essential step of convincing the cultivator by means of Demonstrations that the Department can really teach him something. Regarding Agricultural Associations, he emphasized the importance of selecting men of the right type if these Associations were to be a success, and after touching on the close connection between agricultural improvement and Co-operative Credit, he referred to a recent proposal to revive the Village *Panchayat*, regarding it as possibly a very useful method of spreading agricultural information. As to the close concentration on restricted problems recommended by Dr. Mann, this should continue only till reliable results were obtained, and should then give way to methods whereby these results could be most widely and rapidly disseminated; these methods were largely influenced by local conditions; leaflets, for instance, were often useless, information having to be given by word of mouth. He advocated an English edition of Agricultural Journals; the large land-holders would, in many cases, profit by getting the sense of an article in the original English, and it would enable the District Officer, whose sympathy and

enthusiasm was essential to efficiency, to grasp more easily the general trend and aim of the work of the Department in his district.

The Report of Committee (c) on subject IV is not printed in these Proceedings.

In view of the comparatively short time at the disposal of the Committee for drawing up the Report, and recognising the extreme desirability of obtaining with as little delay as possible a really full and adequate presentation of the Committee's views on a subject of such fundamental importance, the Board decided to refer the Report back to the members of the Committee individually for amplification of the details which specifically affect each Province. The members will return the Report thus amplified to Dr. Mann, who will prepare a consolidated report and this, after endorsement by the members of the Committee, will be published as a separate document by the President.

SUBJECT V.—Touring of Agricultural Experts outside their own Provinces.

The Report of Committee (*d*) was considered. The President referred to his own experience of the very great educational value of touring and in the course of a general discussion the opinion of the Board, as a whole, was to the effect that touring with some definite object in view should be facilitated as far as possible.

The Board accepts the Report of Committee (*d*) as follows:

The Committee on discussing the matter learn that permission has been granted in many cases to members of the various Provincial Departments to visit other Provinces for specific purposes, and they recognise the utility of the principle. In cases where an officer is deputed by his own Government to visit another Province, it is essential, in order to gain the greatest advantage, that timely notice should be given and proper arrangements made with the Department of the Provinces visited.

SUBJECT VI.—Agricultural Education.

Report of Committee (e).

The subject prescribed for discussion by this Committee was sub-divided under the following heads :—

(*a*) the progress made and the difficulties experienced in giving Agricultural Education in India ;

(*b*) the course of instruction at Pusa as explained in the Provisional Prospectus recently issued, with special reference to the following points :—

(1) whether the Syllabus sufficiently emphasizes the function of the Pusa College as a higher teaching Institution intended for students who have already passed through the course of a Provincial College,

(2) whether it makes sufficient provision for research ;

(*c*) the need of a permanent Committee to give year by year general advice to the Board as regards (*a*) and (*b*).

The Provisional Prospectus of the Pusa Research Institute is printed as an Appendix (Appendix A, page 47), together with the Committee's recommendations thereon.

Section I.

The Committee do not feel that they are in a position to record any opinion on the subject of Agricultural Education in primary or secondary schools. This branch of Agricultural Education is under the Director of Public Instruction and none of the members of the Committee have had any experience in the subject.

Section II.

Subject VI (a)—

2. *Agricultural Education in the Provincial Colleges.*—There is no College in Burma or Eastern Bengal and Assam. The latter Province will utilise the Bengal

College, which is not expected to begin teaching before November 1910. The Punjab College will not open till July 1909. Teaching has recommenced in Madras at Coimbatore and the full course is being given in Bombay, the United Provinces and the Central Provinces.

3. The difficulties met with so far have been the following:—

(1) The difficulty of getting the students to take part in the actual agricultural operations. This difficulty is being got over by making such practical work an essential part of the course without which the diploma cannot be obtained.

The Committee is of opinion that practical work should form an essential part of the College course from the first year.

(2) The difficulty of attracting a suitable class of students. There has been no difficulty about applications for admission to the various Colleges, but many applicants were merely attracted in the hope of thus easily entering Government service, and had neither natural aptitude nor interest in agriculture, but means to remedy this have been adopted with some success in various Colleges.

(3) The insufficiency of the teaching staff of the Colleges to deal with large classes of students in practical and laboratory work. This is a difficulty which is felt throughout. In Bombay and the United Provinces, the classes are divided into sections for such work, but the strain on the teaching staff is much increased thereby.

(4) The Committee recognises the difficulty of maintaining the efficiency of the subordinate teaching staff through their getting into a groove and through not keeping in touch with agricultural practices in all parts of the Province.

The Committee is of opinion that these difficulties can be surmounted by encouraging the subordinate teaching staff to tour in the Province whenever their services can be spared from the College. If some arrangement could be made for them to visit Pusa from time to time, it would, in many cases, increase their efficiency.

(5) The difficulty of getting the subordinate staff of the College to have an agricultural outlook. It is desirable that the teacher of Chemistry, for example, should draw his illustrations as much as possible from every day agriculture: that the Veterinary Lecturer, for example, should pay special attention to the farm animals used in the Province.

The Committee is of opinion that this depends upon the general tone of the College and should receive the Principal's special attention. The difficulty will disappear as soon as the Colleges are staffed with their own graduates.

(6) The difficulty experienced through the wideness of the curriculum laid down by the Board of Agriculture, especially in the earlier parts of the course.

(7) The undue length of the terms laid down for some Provincial Colleges which results in staleness both of the staff and the students.

The Committee is of opinion that the working year should not exceed nine months, but that the actual dates of terms must be left to be decided according to the exigencies of each Province.

(8) *Difficulties hitherto experienced at Pusa.*—The experience gained so far has been limited. All Sections actually at work have received students, but these have, for the most part, been insufficiently prepared to derive full benefit from the teaching of which Pusa is capable. In several cases, the students had to be rejected after some months of the time of the teaching staff had been wasted.

As regards the training of the Assistant staff at Pusa, more success has been attained in many cases with men who have not had a University education. The University graduates hitherto available have usually belonged to a class who are not interested in this type of subject.

The Committee feels that the experience at the Provincial Colleges and at Pusa has been so small that it is impossible to come to any definite conclusions on the class of student which it is desirable to attract, but the indications are that the aim should be rather to give an agriculturist a scientific training than to teach agriculture to a man trained in science.

SECTION III.

Subject VI (b)—

The Course of Instruction at Pusa as explained in the Provisional Prospectus recently issued.—The first point considered by the Committee was a definition of the aim of the higher teaching at Pusa. The Committee is of opinion that the aim of the higher teaching at Pusa should be to produce a class of men who will be able to carry out original investigation themselves and also be qualified for teaching or specialised work in the Provinces. At the same time, they recognise that it is impossible to separate the research work and the training to be given at Pusa. The two are intimately connected and the training that the staff can undertake depends on the class of work being done in the Laboratories and experimental fields at Pusa. The training in research is of the highest importance to the Agriculture of India. The Committee considers that it should be made clear that the Syllabus before them is a tentative one to provide for a Post-graduate course suited to the class of student which it is expected will be received in the immediate future, that it is liable to revision as soon as the Provincial Colleges are in a position to send more highly-trained men and that a class of research students is contemplated for which this Syllabus does not provide.

They recommend that paragraph 4 of the Syllabus should commence as follows :—

> "In the absence of experience of the class of student likely to be received, it is impossible to lay down a permanent syllabus of the training in each subject. The syllabus that follows is tentative and is subject to the condition that time will not be wasted in taking students over ground that is already familiar to them."

The Committee then proceeded to consider the Syllabus in detail. Their recommendations regarding each Section will be found in Appendix A.

Subject VI (b)—

(2) How far the syllabus makes sufficient provision for research.

The Committee is of opinion that the syllabus makes as much provision for research as is possible under the circumstances, but they understand that a much larger scheme for the encouragement of research amongst advanced students is in contemplation.

The Committee desires to emphasize the importance of the superior officers of the staff both of the Provincial Colleges and of the Pusa Institute coming into daily personal contact with the students individually. They attach very great importance to the effect of such personal contact on the character of the students and the character of their work.

Subject VI (c)—

The need of a permanent Committee to give year by year general advice to the Board as regards the progress and difficulties in agricultural education both in Pusa and in the Provinces.

The Committee is of opinion that a standing Committee of this kind would serve a useful purpose. This body would examine the report of each Agricultural College and after considering the local successes or failures in the various systems in use would recommend to the Board what modifications or additions they considered advisable. Each College would, of course, be represented on this Committee which should also include at least one Director of Agriculture and an Educational Expert. The body might also be empowered to add to their number for special reasons. The Committee is of opinion that it would be sufficient for this body to meet biennially and suggests that the first meeting should be held next year at Pusa.

SUBJECT VI.—AGRICULTURAL EDUCATION.

The Report of Committee (e) was considered.

An interesting discussion on Agricultural Education in Provincial Colleges revealed a certain divergence of opinion as to the class of student it was most advisable to attract in the interests of Agriculture. Mr. Couchman advocated the principle of Agricultural Colleges for the agriculturist, and deprecated raising the standard of examinations to make them equivalent to the B.A., since this must lead to many students not interested in Agriculture taking the course simply with the object of entering other branches of Government service. Mr. Keatinge, on the other hand, while aware that a considerable proportion of the agricultural students in Bombay entered the Revenue Department, was of opinion that such men were not lost to Agriculture but would assist the Department by introducing improvements and organising agricultural matters in their charge. Mr. Hemingway agreed that such men would be most useful if they could be found in every district. Mr. Renouf supported Mr. Couchman's views, adding that in the Punjab the Revenue Officers were already familiar with agriculture to an extent sufficient to enable them to render suitable assistance. With reference to the numerical ratio between the teaching staff and the students, the Board is of opinion that it is impossible for a teacher to teach in one practical or field class more than fifteen students, and that in cases where a teacher has more than this number of students it is necessary for him to be assisted by a demonstrator for every fifteen additional men.

The Board adopts the Report of Committee (e) on subject VI.

SUBJECT VII.—THE INTRODUCTION OF GOOD INDIGENOUS METHODS OF CULTIVATION, IMPLEMENTS AND CROPS.

Report of Committee (c).

The Committee is of opinion that in attempting to transfer indigenous methods, implements or crops from District to District or from Province to Province, it is absolutely essential that it should be first ascertained that the introduction is not only agriculturally adapted to the new District, but that it is economically sound and suited to the local conditions which prevail. When this is certain, the methods detailed in the report under subject IV may be applied in each case as seems most suitable.

The main difficulty consists in ascertaining what methods can, with advantage, be transferred from Province to Province. Information as to these may be obtained by actual tours of enquiry, by reference to annual reports and departmental publications, by subsequent consultation at the Meetings of the Board of Agriculture and by visits to Provincial Agricultural Exhibitions.

The Board adopts the Report of Committee (c).

SUBJECT VIII.—THE SIZE AND EQUIPMENT OF AGRICULTURAL STATIONS, DEMONSTRATION PLOTS AND SEED-FARMS.

Report of Committee (c).

The term Agricultural Stations covers areas for experiment, demonstration plots and land retained for seed-growing.

Experimental Areas.—It is difficult to lay down any general standard of area for the land required for experiment at an Agricultural Station; but experience seems to show that a maximum of fifty acres will, ordinarily, be sufficient. At the same time, it is apparent that this area may sometimes have to be exceeded, or that, on other occasions, a very much smaller area may be sufficient. It is recognised that at the Central Research Station or the principal station of a Deputy Director's Circle, a larger area may be necessary, since wider investigations are there in progress, and more detailed supervision is exercised.

The feeling of the Committee is that expenditure in unnecessarily elaborate buildings or equipment is to be strongly deprecated. Buildings should be of a type and class such as an ordinary substantial cultivator would be well advised in providing. But it is of course understood that it is essential to ensure the accuracy

of the experiments. The cattle should ordinarily be such as a cultivator could profitably use and of the best type available in the District in which the station lies.

Demonstration Areas.—Demonstration areas divide themselves into those forming part of an agricultural station and those which are carried out on cultivators' land in co-operation with them. It is impossible to fix a definite area in either of these cases. This must depend entirely on the special circumstances of the case. All that can be said is that demonstrations should be carried out on a field scale. Usually no special equipment is needed for these areas.

Seed-Farms.—The policy with regard to seed production should be to get the seed for distribution grown for the Department, by arrangement with cultivators. The Committee do not think that large Departmentally owned seed farms are desirable; but a certain portion of the agricultural station should be set aside for the propagation of selected seed, sufficient to supply the cultivators growing seed for the Department. These areas can, in many cases, be used for demonstrations. The size will again depend on circumstances.

The most important item of equipment will be a seed store, which should be well built and substantial. When seed has to be kept for a long period in store, the Committee consider that it would be better to keep it at a few centres than to multiply the number of small seed godowns.

The Board adopts the Report of Committee (*c*).

The President promised to write a note describing the management and the equipment of Agricultural Stations, Demonstration Areas and Seed-Farms and the methods to be adopted in field experiments. It was considered advisable to include in this note a statement of the staff that will be required for efficient work and the rates of pay which will be necessary to attract and keep the best class of men. The President undertook to circulate this note to members of Committee (*c*), so that it may be modified to suit the requirements of all the Provinces before it is published.

SUBJECT IX.—A DISCUSSION ON THE BEST MEANS OF TRAINING INDIAN OFFICERS IN THE MANAGEMENT OF AGRICULTURAL STATIONS.

Report of Committee (e).

The Committee is of opinion that in all cases where possible only men trained in scientific method should be employed. It appears also desirable that the men should receive a limited amount of office training to ensure punctuality, obedience to orders and a knowledge of office routine. The best results have been obtained where such men are trained in practical work under the direct supervision of the Deputy Director with whom they are to work. In Madras a special feature of this training is that the men are taken on tour by the Deputy Directors and the Committee recommends that this course should be followed in other Provinces. In all cases experience for some years on one of the agricultural stations in a subordinate position would seem to be desirable. It is a very important part of the Deputy Directors' duties to train such men and the Committee would emphasise the importance of close personal contact with a superior officer of the Department if the best results are to be obtained.

A short discussion took place regarding the facilities for providing office training, which varied in different Provinces.

The Board adopts the Report of Committee (*e*).

SUBJECT X.—THE RELATIONS OF THE DEPARTMENT WITH THE PRESS.

The President in opening the discussion referred to the first Agricultural Conference in Bombay which preceded the appointment of the Board of Agriculture. This took the form of an instructive tour through the Presidency; the presence on that tour of a correspondent of the press had led to the appearance of a series of interesting articles on agricultural matters whereby the public were enabled to gain clear ideas as to the aims of the Department and the nature of its work. He was inclined to encourage the use of the press as a means of making more widely known to the general public the proved results of useful agricultural work effected by the Department. A general discussion ensued: Dr. Butler suggested as a possibility a

paper run on commercial lines, not definitely a Government publication but controlled as to accuracy alone by the Department. Mr. Moreland explained the arrangement whereby United Provinces Agricultural Notes appeared in the *Pioneer*, and Mr. Noël-Paton remarked that signed articles on subjects such as would really interest traders could be published in the *Trade Journal*. The general feeling of the Board was that a more extended use of the Press should be made with regard to the general work, results gained, and methods employed by the Department.

The Board resolved that members of the Agricultural Department should be encouraged to *contribute agricultural information to the leading newspapers in their Provinces.*

APPENDIX A.

THE PUSA AGRICULTURAL COLLEGE AND CENTRAL RESEARCH INSTITUTE.

(PROVISIONAL) PROSPECTUS.

1. PREFATORY.

The Pusa Agricultural College and Central Research Institute owes its inception to the generosity of Mr. Henry Phipps, who in 1903 placed at the disposal of Lord Curzon, then Viceroy and Governor General of India, a donation of £20,000 (which he afterwards raised to £30,000), with the request that it might be devoted to some object of public utility in India, preferably in the direction of scientific research. Part of this donation was devoted to the construction of a Pasteur Institute at Coonoor in Southern India, and it was decided that the balance should be utilized in erecting a laboratory for agricultural research which it was hoped would form a centre of economic science in connection with that occupation on which the people of India mainly depend. This conception was subsequently enlarged, and the Government of India have now constructed a College and Research Institute to which a farm of some 1,300 acres is attached for purposes of experimental cultivation and demonstration.

In 1903, when the Research Station was sanctioned, it was intended to combine it with a college which should give a general agricultural education and should serve as a model for the few agricultural colleges and schools of very unequal merit which then existed in India. Recently, however, this conception of the functions of the Pusa College has undergone a material change. It is now recognized that the first and most essential condition of any permanent improvement in the agricultural methods of this country is the widest possible diffusion of an organized knowledge of scientific and practical agriculture, and at the same time it is desired to make the country as far as possible self-supporting in the matter of the development of agricultural training and research. A comprehensive scheme for the promotion of agricultural education throughout India has accordingly been drawn up, as the result of which it is hoped that every important province will soon be provided with a fully-equipped college where students will for three years receive practical and scientific education in agriculture. The position which the Pusa College is intended to occupy in relation to this general scheme is that of a higher teaching institution. Its main object is to enable students who have passed with distinction through a course of a Provincial College, by means of a post graduate course in one of the specialized branches of agricultural science, to qualify for the higher branches of agricultural work.

2. THE PUSA ESTATE.

The estate consists of 1,300 acres, of which 400 are arable, 400 are pasture; nearly all the field crops of the plains can be grown there. The farm buildings are up-to-date and herds of breeding and milch cattle are maintained. There are complete arrangements for the manufacture of indigo and the curing of tobacco. Poultry breeding is being carried on; there is a large and well laid out orchard and Botanical Garden. Every facility for the practical teaching of agriculture and agricultural subjects has been provided. The students' laboratories are extensive, well lighted and equipped; there is a library for the use of students. The students hostel is complete, and there is ample accommodation for 70 students. Waini, on the Bengal and North-Western Railway, is the nearest railway station. It is 6 miles from the college by a good road. There is a telegraph and post office within the estate.

3. CONSTITUTION AND STUDIES.

1. *Control.*—The College is under the general supervision of the Inspector General of Agriculture in India and is under the direct control of the Principal of the College and Director of the Research Institute.

2. *Staff.*—The superior staff of the college consists of—

(1) *The Principal.*

(2) *The Imperial Agricultural Chemist.*

(3) *The Imperial Mycologist.*

(4) *The Imperial Entomologist.*

(5) The Imperial Economic Botanist.

(6) The Imperial Agriculturist.

(7) The Imperial Agricultural Bacteriologist.

(8) The Second Imperial Entomologist.

3. *Course.*—The ordinary college course extends over two years,* and the students will be trained in one or other of the following sections of agricultural science, no students being trained in more than one section at one time :—

(1) Agricultural Chemistry.

(2) Economic Botany.

(3) Economic Entomology.

(4) Mycology.

(5) Agricultural Bacteriology.†

As a temporary measure, however, a general agricultural course in various subjects will be provided in 1908 and 1909, in order to train Indian Assistants for Provincial services.

4. *Syllabus.*—The following provisional syllabuses are given for information :—

I.—Agricultural Chemistry.

(Two years' course.)

(*a*) Practice in general methods of quantitative analysis such as the determination of lime, phosphoric acid, etc., in pure materials.

(*b*) The preparation of one or two pure substances, inorganic and organic, such as copper sulphate, aniline, or common alcohol.

(*c*) The analysis of agricultural materials, such as soils, manures, feeding stuffs, waters, chief ingredients of the atmosphere.

(*d*) The execution of special parts of investigations which are in progress at Pusa, or the repetition of an investigation which has been completed.

(*e*) The execution of new lines of work.

(*f*) Short courses of lectures on special subjects which have been under investigation in one or other parts of the world.

(*Note.*—It will naturally happen that some students will, owing to previous instruction in quantitative work or owing to greater ability, progress more rapidly than the others. It is anticipated that usually only Sections (*a*), (*b*), (*c*) and (*f*) will be completed in the first two years, but students having progressed rapidly with these stages will be given work under sections (*d*) and (*e*) as soon as possible.)

(1) Agricultural Chemistry.

The Committee recommended that the following Syllabus should be substituted :—

1. A course of lectures and laboratory practice of the same type as laid down in the Standard Curriculum for Provincial Colleges.

2. A course or courses of lectures in advanced Chemistry which shall follow such lines as have an important bearing on Agricultural Science. Each student will then take up a particular line of investigation suggested to him by the lecturer. At the end of the course, each student will write an essay embodying the whole of his work and the results positive or negative he can deduce therefrom.

* The entomological course will be for one year only.

† This subject will not be taken up at present.

II.—Botany.

(One year's course.)

1. *Plant Physiology.*—The course will mainly consist of practical work based on Darwin and Acton's Practical Physiology (Cambridge University Press) and adapted to Indian conditions.

2. The improvement of plants : including variation, plant-breeding and plant selection.

3. In the case of students who show special aptitude for work in Economic Botany and who are likely to become qualified to undertake original work, the course will be extended to two years.

Second year.

In general this second year's work will deal with the practical application of the principles of plant improvement and a general knowledge will be given to students of the planting, cultivation and improvement of plants which are of special economic importance in their respective provinces.

(II) Botany.

The Committee recommends that the following more detailed Syllabus for the first year suggested by Mr. Howard should be substituted.

Syllabus of Post-graduate Studies in Economic Botany at Pusa.

I. *Physiology of Plants.*—The course will be mainly practical and will be based on Darwin and Acton's Physiology of Plants (Cambridge University Press).

The work will illustrate the effect of various conditions on plant development and will include :—

(*a*) Respiration.
(*b*) Assimilation.
(*c*) Nutrition.
(*d*) Transpiration.
(*e*) Growth.
(*f*) Movements.

II. *The improvement of Plants.*—The lectures will deal firstly with the principles underlying the modern development of plant breeding, such as Mendel's Law and Mutation, and secondly with the particular method adapted to Indian conditions and this part of the course will be supplemented by field work.

The subjects treated will be—

(*a*) Evolution, Variation and Mutation.
(*b*) Selection, including the isolation of elementary types.
(*c*) Hybridisation.

III. *The Principles of Indian Fruit-growing.*—The course will include—

(*a*) The general management of a modern fruit garden.
(*b*) Special processes such as Propagation, Pruning and Root-pruning. Weathering.
(*c*) Disposal of the produce.

III.—Entomology.

(One year's course.)

Summary of courses.

1. Collecting, pinning, setting.
2. Classification.—How to use text-books.

How to use the collection.

3. *Anatomy of cockroach or other form.*
Comparative anatomy as shown by dissection, mouth parts, etc.
Terms used in classifying.
4. Classification and terms used in each order.
5. Actual identification and revision of the collection.
6. Biology and life histories :—
General, special and details.
7. An account of each family in order.
8. Pests—first general,
then special by order.
then special by crops.
9. Complete list of the injurious insects in India.
10. Preparation of leaflets and lecture course for the Province, with exhibition collection of insects of that province.
11. Useful insects—(Lac, silk, apiculture).
12. Beneficial insects and birds.
13. Preventive and remedial measures.

III.—ENTOMOLOGY.

The Committee has no recommendations to make regarding the Entomological Syllabus.

IV.—MYCOLOGY.

(Two years' course.)

1. *A revisionary course in Plant anatomy and physiology.*—(Time : two to three months.)

Anatomy.—Histology of the cell and tissues. Anatomy of the root, stem, leaf.

Physiology.—Physiology of nutrition.

2. *General Mycology.*—(Time : six months.)

Definition and characters of the fungi.

Structure of the thallus—

(*a*) Vegetative portion, mycelium, rhizomorphs, sclerotia.
(*b*) Reproductive portion ; sporophores ; spores ; germination.

Life habits of fungi.

Dissemination.

Polymorphism.

Food of fungi ; saprophytes, parasites.

Symbiosis.

Heteroecism.

Specialisation of parasitism.

Classification. The study of the six main groups of fungi with examination of types.

3. *Pathological Mycology.*—(Time : 15 months.)

Causation of disease by fungi. Infection.

Effects of parasitic fungi on plants.

Diagnosis of disease ; symptoms of fungus attack.

Prevention and treatment of fungus diseases of plants.

Predisposition of plants to disease ; immunity.

Factors of disease. Epidemics.

A general study in field and laboratory of the principal fungus diseases of crops in India.

A more detailed study with experiments of a selected fungus disease.

If possible the student should accompany a trained assistant in a field enquiry for the purpose of giving him practice in independent observation and collecting information.

IV.—MYCOLOGY.

The Committee has no recommendations to make regarding the Mycological Syllabus.

V.—BACTERIOLOGY.

(The syllabus in Bacteriology will be prepared at a future date, as the subject is not ripe for educational work and students will not for the present be admitted to this section.)

V.—BACTERIOLOGY.

The Committee is of opinion that as the Bacteriological Section will open shortly the following Syllabus should be substituted :—

A short course in Bacteriological methods, preparation and sterilisation of media and the cultivation of bacteria.

Students who have passed through this training satisfactorily will take part in the research work of the laboratory under supervision.

It is considered that the subject can best be dealt with thus, as knowledge in Agricultural Bacteriology is not yet sufficiently advanced to provide a more general course.

VI.—AGRICULTURE.

Agriculturists who have been trained in the provinces and who require some further training in practical agriculture to fit them for the higher executive posts in the subordinate Agricultural Department, such as Superintendents of Farms and Managers of Court of Wards Estates may be deputed to Pusa for a period not ordinarily exceeding a year and will be given facilities for obtaining comprehensive experience in the management of field and garden crops and orchards, and in the use of agricultural machinery, tools and implements, and in cattle, sheep and poultry-breeding.

VI.—AGRICULTURE.

The Committee is of opinion that Superintendents of Farms or others requiring a practical agricultural education should be trained in the Provinces and not at Pusa, except as a temporary measure to assist Provinces which are not in a position to train their own men.

They understand that courses in special subjects for which special facilities exist at Pusa will be given.

The Committee recommends that the following be substituted for the Syllabus :—

"Special instruction will be given in the management of field and garden crops and orchards, and in the use of agricultural machinery, tools and implements, and in cattle, sheep and poultry breeding."

"As a temporary measure to assist Provinces which are not in a position to train their own men as Superintendents of Farms or for other positions requiring a practical agricultural education, a course in general agriculture will be given.

4. ADMISSION RULES.

1. *Accommodation.*—The total number of students that can ordinarily be admitted in each of the following sections every year is as follows :—

Agriculture	8
Agricultural Chemistry	8
Mycology	8
Entomology	8
Botany	8
	40

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The number of studentships to be allotted each year to the respective Provinces as well as the number of nominations, if any, to be made by the Principal will be decided by the Principal before the 1st April, after consultation with the Provincial authorities as to their requirements, and communicated to the Local Governments and Administrations concerned.

2. *Students.*—There will be three classes of students—

(1) Students nominated by a Local Government or an Administration.

(2) Students deputed by a Native State.

(3) Private students.

3. (*i*) *Students nominated by a Local Government or an Administration* will ordinarily be men who have passed through a Provincial Agricultural College with distinction, and who are qualified to profit by a post-graduate course in specialised branches of agriculture. Preference will be given to these men. But science graduates of an Indian University, especially those who have applied for employment in a Provincial Agricultural Department may also be accepted, and for the first few years, selected men already in the Agricultural Department may be deputed from provinces where the agricultural colleges are not in full working order, provided that the Local Government is satisfied that they are qualified to profit by the Pusa course. In special cases, particularly in the section of entomology, candidates of special aptitude and of good general education will be admitted on the recommendation of a Local Government if the recommendation is supported by the Inspector General of Agriculture and the head of the section concerned.

4. *Students deputed by a Native State* may be admitted on the application of the State concerned, provided that accommodation is available. Applications should be addressed in the first instance to the Inspector General of Agriculture in India, Nagpur, Central Provinces, and should reach him before the 15th March. The nomination of such students is made by the Inspector General of Agriculture, and his nomination should reach the Principal before April 1st, as provided in rule I above.

5. Detailed rules regarding the admission of private students will be framed later.

6. Students of classes (2) and (3) above will be required to pass a satisfactory test to be applied by the chief of the section concerned at Pusa.

7. The expenses of a student at the college will, it is estimated, not exceed Rs. 25 per mensem. But the following sums will approximately be required for the purchase of books :—

	1st year.	2nd year.
Agricultural Chemistry	Details to be furnished later.	
Economic Botany		
Entomology		
Mycology		
Agricultural Bacteriology		

8. Local Governments will be left to make students whom they depute to the college such allowances and grants as they think fit. In the case of students already in Government service, the allowances should not exceed the pay of their grade and in case of other students they should not exceed Rs. 50 a month.

9. Caution money and initial deposits will not be required from students nominated by Local Governments, except in the case of students required to undergo training at the college at their own expense, who must deposit with the Principal a sum of Rs. 100 to meet the initial cost of books and in addition Rs. 50 as caution money.

10. It will be at the discretion of the Principal with the advice of the scientific officer in charge of the section to declare at any time the unfitness of a student for training and to require his removal from the college.

5.—Disciplinary Rules.

The Director and Principal is charged with the general control of the students, the housing and domestic arrangements, and the maintenance of discipline, and he will from time to time issue such rules and regulations as may be necessary to secure these objects. All the correspondence relating to the training of students should

be addressed to the Director and Principal, Agricultural Research Institute and College, Pusa, Bengal.

2. (1) *Quarters.*—The Principal will allot to students on arrival such quarters as may be available. The College quarters are tenable during the whole period of the student's course. For the present no rent will be charged for the quarters, but the Government of India reseve the right of withdrawing the concession from all or any class of students entering the College hereafter.

(2) Students must make their own arrangements for meals. Separate dining rooms will be provided for different castes and religions, and meals will not be allowed in quarters without the consent of the Principal.

(3) Every student will be responsible for articles placed in his charge. In case of loss or damage arising from carelessness he may be called upon to pay.

(4) Students will not be allowed to keep dogs. Horses and cattle cannot be kept without the permission of the Principal.

(5) No student may leave the estate premises without the permission of the Director and Principal. No student may be absent from his quarters after 10 P.M. without the permission of the Director and Principal.

3. *Library.*—The use of the library will be allowed subject to the Library rules.

4. *Books and Instruments.*—The list of books required by students of each section will be published by the Principal from time to time. Apparatus and other laboratory requirements will be provided free, but students using them will be responsible for their safe custody and return.

5. *Leave.*—During the course of instruction no student may leave Pusa without the order of the Principal. Subsidiary rules regarding leave will be made by the Principal from time to time.

6. *Holidays.*—Such of the usual gazetted holidays as are allowed will be notified from time to time.

7. *Punishments.*—Students are liable to the following punishments, which may be imposed by the Principal:—

Entry in conduct register.

Stoppage of leave or fine.

Removal or dismissal from the College. An extract of the order of this kind passed by the Principal shall be forwarded to the Local Government or Native State concerned for information.

The Committee is of opinion that section 3 (i) of the admission rules should be made as wide as possible so as not to exclude students from other institutions and they suggest the following should be substituted :—

(1) Students nominated by a Local Government or an administration.

(2) Students deputed by a Native State, on the nomination of the Inspector General of Agriculture in India.

(3) Students nominated by the Principal.

Students of class (1) above should have passed with credit through a Provincial Agricultural College, be graduates of Indian Universities, or possess a degree or diploma of at least the same standard at any other Educational Institution of University rank. In case of nominations made on behalf of a Local Government, the recommendation of the Provincial Chemist in the case of the Chemical Section, of the Director of Agriculture of the Province supported by a Provincial Expert in the case of the Entomological Section and of the Provincial Economic Botanist in the cases of the Botanical and Mycological Sections, should be obtained and these officers should satisfy themselves that the candidates possess sufficient knowledge and training to be likely to profit by a Post-graduate course at Pusa.

Students of classes (2) and (3) above should pass a satisfactory test to be applied by the Chief of the Section concerned at Pusa.

(4) It will be at the discretion of the Principal with the advice of the Scientific Officer in charge of the Section, to declare at any time the unfitness of a student for training.

APPENDIX B.

NOTE ON THE EXTENSION OF CULTIVATION OF FIBRE PLANTS IN INDIA.

The following is a report drawn up by a Committee consisting of Messrs. Gammie, Burkill, Finlow, Clouston and Subba Rao, for the information of the Board of Agriculture. It was prepared in 1908, laid before the Board for criticism and subsequently slightly amplified by the Committee on information obtained by the Inspector General of Agriculture from the Directors of Agriculture of the various provinces :—

2. The Committee limited consideration to particular crops :—

(1) Ryot's crops—Jute, *Hibiscus cannabinus, Crotalaria juncea* and Coconut.

(2) Capitalists' crops—Rhea, Agave, Pine-apple, Sansevieria and Flax.

(3) Fibres worth experimental attention, *e.g.*, Plantain, Malachra and Sida.

Jute in Bengal and Eastern Bengal and Assam.

3. At present the cultivation of jute is practically confined to Bengal and Eastern Bengal and Assam. In both of these Provinces, it is one of the most important crops, and its cultivation has increased rapidly, owing to high prices during recent years. While there is little doubt that, in some districts, jute has replaced rice to a certain extent, the ryots who grow jute now generally know that paddy or a rabi crop can usually be grown in the same field in the same year. This should be considered by those who think that the extension of the cultivation of jute would seriously interfere with the food-supply of the country, for, on the other hand, the little diminution in outturn of rice caused by increase of jute is more than compensated by the increase of the buying capacity of the country on the return of the more profitable crop.

The cultivation of jute is extending to new areas.

4. The cultivation of jute is extending in Assam and is very profitable there. Large areas of virgin land are available for the crop. Its cultivation increased rapidly in Behar during the years 1904-1907 when prices were high; but latterly the area has largely decreased. Its place in the crop rotations of this tract is still indefinite.

Experimental trials of jute in other parts of India.

5. During the last four years, trials with jute have been made in other parts of India. The results of the experiments indicate that jute might be grown successfully in—

(*a*) The Deltas of the Gadavari and Krishna } Madras.
(*b*) The Malabar Coast } Madras.
(*c*) The Chhattisgarh and Nagpur Divisions (with irrigation) } Central Provinces.

Experiments in Madras.

6. In the Madras Presidency, a number of private land-owners are trying jute in small areas on the Malabar Coast districts. Experiments in the Kavery delta have been abandoned, as want of skill on the part of the cultivators and the remunerativeness of paddy argued no success. The same causes will probably hinder progress in the Godavari and Kistna deltas.

Experiments in the Central Provinces.

7. In the Central Provinces, the crop will continue to be grown on demonstration plots. Its cultivation will probably be limited to tank irrigated areas where it may possibly alternate with wheat, the latter being a dry rabi season second crop.

Experiments in Bombay.

8. In Bombay, the experiments were not successful, and the crop is not likely to be introduced successfully anywhere in the Presidency.

Experiments in the Punjab.

9. It is not likely that Jute can be profitably grown in the irrigated districts of the Punjab, unless practical arrangements can be made for retting the crop. Tanks filled from the canals would as a rule be required.

10. In the United Provinces of Agra and Oudh there does not seem to be, at average prices, much room for this crop in the districts served by the canals, and if the crop is grown to any extent, difficulties may arise, as in the Punjab, in making proper arrangements for retting.

Experiments in the United Provinces.

11. Jute has been successfully cultivated in the lands belonging to the Maubin Jail in the Irrawaddy Delta for a number of years. But although this success has been duly advertised and quantities of seed have, from time to time, been distributed to other parts of Burma, the experiments have failed to induce general cultivation. The crop has not become popular in Burma probably on account of the dearness of labour and the extra trouble involved in its cultivation as compared with paddy. A number of private individuals have, however, taken up jute cultivation in an experimental way. The suitability of the crop for Lower Burma will be particularly studied at the Hmawbi Agricultural Station, especially in regard to the right times of sowing the varieties which can be most profitably grown and the possibility of growing rice and jute on the same land in the same year. It is believed that the development of jute cultivation on any commercial scale will depend on the erection of a Jute Mill in Rangoon or any other convenient centre, but the cost of labour in Burma, as compared with India, may form a serious commercial disadvantage.

Experiments in Burma.

12. *Hibiscus cannabinus* (Ambadi, Mestapat, Gogu, Sankukra)—This plant is cultivated in many parts of India as a mixed crop, but rarely as a pure crop excepting on the East Coast of Madras, and, to some extent, in the jute-growing districts of Bengal. It grows excellently on well drained land in a wet climate such as may be found in the jute districts, but it is capable also of thriving under conditions which would not suit jute without irrigation. In this last fact lies the importance of the plant. There is no advantage to be got by extending its cultivation where jute will easily thrive; but in regions of more moderate rainfall the cultivation of *Hibiscus cannabinus* might profitably be extended.

Bombay Hemp—its general cultivation.

13. In Madras, its cultivation is firmly established in Vizagapatam and Guntur, which include $\frac{8}{9}$ths of the total acreage of the crop in the Presidency (68,000 acres in 1906-07). In 1907-08, when the total acreage was 71,476, it was in these two districts 60,620 acres). It has been suggested that the quality of the fibre has deteriorated, but enquiries made on the spot in 1906 indicated that the alleged deterioration is due to fraudulent watering and to carelessness in preparation owing to high prices, rather than to any actual deterioration of the plant. Prices have recently been low. A mill for spinning this fibre and manufacturing it into gunnies, has been worked for some years at Bimlipatam, which probably accounts for the considerable area under the crop in the Vizagapatam District. Another mill has recently been opened at Ellore in the Krishna District and may encourage extended cultivation.

The crop in Madras.

14. The total acreage under this crop in 1906-07 in the Bombay Presidency was said to be 145,623, but for 1907-08 only 97,821 acres are recorded. It is generally mixed with other *kharif* crops, and is remunerative chiefly because the fibre is used for well ropes and other home purposes.

The crop in Bombay.

15. In the Central Provinces, it is grown in mixed crops. Its fibre is considered inferior to that of *Sann* (*Crotalaria juncea*). The general opinion is that *Sann* gives a better outturn of fibre and a greater profit per acre when each crop is planted alone.

The crop in the Central Provinces.

16. The extent of this crop as a mixture in other crops in the United Provinces is not known. It is usually grown as a border crop, and calculations regarding areas and outturn are very uncertain. The fibre obtained in the east of the United Provinces is perhaps of better quality than that grown in the west.

The crop in the United Provinces.

17. *This fibre plant occupies in the Punjab an insignificant area. It is frequently grown as a border crop round sugarcane, cotton and maize, as a protection against straying cattle. It is never grown in separate plots. The produce is chiefly used locally.*

The crop in the Punjab.

18. This crop is cultivated, to some extent, throughout Upper Burma. It is not likely in the near future to have any particular commercial importance. The total area is at present about 10,000 acres.

The crop in Burma.

19. *Crotalaria juncea.*—The fibre of this crop does not compete with jute as does that of *Hibiscus cannabinus*, but in market value it is superior to both. Sann-hemp can best be grown in districts of moderate rainfall, and, therefore, does not compete with rice. It is, in some parts of India, frequently grown as a green manure crop before rice, and in others as a second crop in the same year after early rice for fibre. This rotation is advantageous, because sann is a leguminous crop.

Sann-Hemp—General remarks.

20. The total acreage under the crop in the Bombay Presidency in 1906-07 was 23,700 acres and in 1907-08, 26,470 acres. It is chiefly grown as a *kharif* crop for fibre, but also to a considerable extent as a green manure crop. In the Thana District, it is grown as *rabi* crop in succession to early rice for fibre, which is used in making twine for nets by the fisherman.

Cultivation in Bombay.

21. The returns for Madras give a total of over 300,000 acres ; but it is known that only a very small proportion of this—a few thousand acres—is grown for fibre. It is most extensively cultivated for fibre in the Northern Circars, chiefly in the Amalapuram and Narsapur Taluks of the Godavari and Krishna Districts. In the rest of the Presidency with the exception of the Tinnevelly District, where some fibre is manufactured into extremely durable gunny bags, the cultivation of the crop is confined to the production of fodder.

Cultivation in Madras.

22. In Eastern Bengal and Assam this crop is largely grown in the Serajganj sub-division of the district of Pabna where the estimated area is 33,900 acres. Generally it is grown in Serajganj on land which bears a jute crop in the same year. The area in Chittagong, where it is also grown as a rabi crop decreased from 7,900 acres in 1906-07 to 1,600 acres in 1907-08. The total estimated area in Eastern Bengal and Assam is about 42,000 acres and the estimated export of the fibre is 30,000 maunds. In this Province jute is much more important, but it is possible that the cultivation of Sann-hemp can be somewhat extended with profit, though as the water-supply for retting is limited in February and March, the months of its cutting, this would only be along the banks of rivers. In the Serajganj sub-division it is only grown for fibre quite close to water.

Cultivation in Eastern Bengal and Assam.

23. A note by Mr. Clouston, the Deputy Director of Agriculture in the Central Provinces, on the cultivation of fibre plants in the Central Provinces has been published in the *Agricultural Journal of India* (April 1908). The total area under *Sann* in the Central Provinces was 55,400 acres in 1907 which increased in 1908 to 85,044 acres. In Berar in 1907 the acreage was 32,360 and in 1908, 35,484. It is always grown as a pure crop and is cultivated for its fibre chiefly, while the seed is a valued cattle food. It is generally believed that only one variety of *Sann* is grown throughout the Central Provinces and Berar. Retting costs a good deal. A suitable cheap machine to extract the fibre might be advantageous in extending the cultivation. The area in the Central Provinces has been nearly doubled during the last ten years. *Sann* cultivation is so profitable that the crop has been largely substituted for wheat. The cultivators understand that this crop is a hardy one and improves the condition of the land. It is grown to a small extent as a green manure crop, particularly for irrigated wheat and sugarcane. In the cotton tracts no extension of this crop can be expected, as cotton pays better. In the rice tracts, *Sann* could probably be profitably grown on much of the land which is planted

Cultivation in the Central Provinces.

with other second crops. The total quantity of Sann-hemp exported from the Province and the value of the same from 1904 to 1906 are shown below :—

Year.	Maunds.	Value.
		Rs.
1904-05	226,751	12,18,783
1905-06	201,402	10,82,534
1906-07	168,096	9,03,513
1907-08	271,727	14,60,532

Cultivation in the Punjab.

24. In the Punjab there were 57,000 acres under Sann-hemp in 1906 and 52,400 acres in 1908; the sub-montane tracts showed the greatest area. Very little is grown in the south-west of the Province. Throughout the Punjab, the crop is usually sown in very small plots, and very little is marketed. The crop is sown almost solely for fibre, but in the Hoshiarpur District, it is estimated that 1-10th of the crop was grown for green manuring. The practice of green manuring with *Sann* is, however, rare at present. The retting and cleaning of the fibre are regarded as very tedious and troublesome processes. Having regard to these troubles the crop is considered to be less remunerative than some other crops. The imports of Sann-hemp fibre into the Punjab in 1906-07 were 15,382 maunds and in 1907-08 20,984 maunds, almost entirely from the United Provinces. The exports amounted to only 4,078 maunds in 1906-07 and 2,584 maunds in 1907-08.

Cultivation in the United Provinces.

25. The returns of the United Provinces show an area in 1906-07 of 133,000 acres of hemp, which include both *Hibiscus cannabinus* and Sann-hemp : and in 1907-08 of 158,000 acres. Practically the whole of this area is devoted to Sann-hemp. It is grown for fibre and almost universally as a border crop with *kharif* crops, the produce being worked up by cultivators into ropes for home use. The export is, therefore, a small part of the produce. The trade returns of the United Provinces for 1906-07 show practically no imports of hemp, but exports aggregating 400,000 maunds valued at 22 lakhs of rupees and in 1907-08 of 409,800 maunds, valued at Rs. 26,17,000; most of this is Sann-hemp. There is a steady trade to Calcutta and a very fluctuating trade to Bombay. The crop is a well recognized feature of the local agriculture, and the trade in fibre is an organized one. The area generally responds to the prices offered.

Cultivation in Burma.

26. This crop does well in the Tavoy District of Tenasserim. It is grown there after paddy. The estimated area is about 400 acres in Lower Burma. The fibre is used for fishing nets. It is very doubtful whether there will be any great development of this crop, unless the Department of Agriculture, Burma, succeeds in introducing it for green manuring.

Coconut Fibre—General remarks.

27. The coconut palm is grown in all the Coast districts of India, but to the largest extent, in the southern portion of the Bombay Presidency and in Madras. In the Malabar Coast districts, the coir industry is a very large one, amounting to many lakhs of rupees per annum. Although this palm takes time to mature, its cultivation is popular, because it supplies food as well as fibre for many years after it has reached the fruiting stage.

Bengal.

28. In Bengal, this palm is plentiful in the lower Gangetic basin ; but it exists practically only in garden cultivation ; there are no large plantations.

Eastern Bengal and Assam.

29. The coconut palm is grown on a large scale in Bakarganj and Noakhali in Eastern Bengal and Assam, but the fibre is never extracted. There seems no reason why this industry might not be introduced with profit into the Province

Burma.

30. Little, if any, attention has in the past been devoted to the fibre of the coconut in Burma, except in the jails. Even for food purposes coconuts have to be *imported largely. The cultivation of the palm for fruit and fibre has been taken up in Akyab by one European. If he succeeds his experience may attract attention to this crop. There is a coir factory in Rangoon, and the collecting of coir for it would seem deserving of encouragement. The want of sufficient cooly labour in Moulmein and other centres, makes it impossible to start coir factories in them. The total area under this crop was returned as 13,590 acres in 1906-07, and* 13,070 acres in 1907-08.

Plantain fibre, general remarks.

31. There are possibilities of a useful industry in plantain fibre. In many parts of India the plantain tree is common in every garden; and in Bengal, Assam, the Bombay and Malabar Coasts, the Delta tracts of Madras and in parts of Burma, whole groves of plantains are quite common. The fibre of the tree which produces good fruit in India is usually, however, far inferior to that of *Musa Textiles*—also a plantain—which is the source of Manilla Hemp. Moreover the amount of fibre obtainable from a plantain tree in India is very small. Experiments have shown that the fibre can be extracted by a simple hand machine; but, in view of the low market price obtainable—as a rule, not much more than half that of Manilla Hemp, it remains to be proved that a plantain fibre industry in India is a commercial possibility. The fibre is of little use for the manufacture of cordage as its strength is below the standard usually demanded for rope making.

The crop in Burma.

32. There are about 124,000 acres under plantains in Burma, but nothing is done with the fibre. The crop might give paying results for fibre after producing fruit.

Sida.

33. Species of Sida are quite common jungle plants in most parts of India; but in order to attain the length necessary for a fibre plant the crop must be grown on well drained land, either in a moist climate or under irrigation. Experiments *under these conditions have given promising results. It is, however, necessary to* overcome certain difficulties before recommending the crop for general cultivation.

Agave and Rhea—General remarks.

34. For the purpose of this note, Agave and Rhea may be taken together. The conditions of soil and climate suitable for these crops are now fairly definitely known. It used to be thought that Agave would grow and thrive on any soil and under any conditions of climate. It has, indeed, been stated that the poorer the land, the better Agave will thrive; but experience indicates that both Agave and Rhea require good land for rapid growth. For the latter also fairly heavy rainfall is required.

Although it is possible to extract both Agave and Rhea fibre by hand, the products obtained are usually inferior to those obtained by machinery. Therefore possibly the cultivation of these plants should, for some time, be continued by capitalists who can afford to pay for expensive fibre extractors. Rhea has been extensively cultivated on the estates of Indigo Planters in Behar, but has not proved a profitable crop. Both Agave and Rhea require some years' growth before they give any considerable yield of fibre, a fact which discourages the ordinary ryot from attempting their cultivation.

Rhea in Behar and Assam.

35. It has been practically proved that the climate of Behar—with a rainfall of 45 inches—is too dry to admit of a sufficient number of cuttings being made per annum to make rhea pay. The results of the recent experiments at Dalsing Sarai and elsewhere have been set forth excellently by Mr. B. Coventry in the Journal of Agriculture for India, 1907, page 1. This crop thrives in the moist climate of Assam where it is possible to obtain five cuttings per annum and where, to a small extent, it is a ryot's crop.

Cultivation in Madras.

37. In Madras, rhea is grown on a small scale in the Shevroys. The Glenrock Company opened a rhea plantation near Metapolliam in the Coimbatore District, but did not make a profit out of the cultivation.

38. Rhea has been under experimental trial for many years, and further recent experiments with it at the Ganeshkhind Gardens, Kirkee, have confirmed the conclusion that the soil and climate of the Deccan are unsuitable for the plant under ordinary circumstances.

Cultivation in Bombay.

39. It is said that in Lower Burma, a variety of the plant grows wild on the banks of streams in the Tharrawady District along the foot of the Pegu Yoma range, and that the fibre is used to make twine for fishing lines. Experimental plantations of *B. nivea* and *B. tenacissima* have been started by the Forest Officer in Tharrawady, who reports that the latter species is growing with success. Rhea grows wild both in the Northern and Southern Shan States. The fibre is chiefly used for making paper, but is also made into cloth and strong twine for fishing lines, etc. Two varieties of the plant are known, one being considered better than the other for the above purposes.

The plant grows wild in Burma.

40. Agave grows in most parts of India, in all classes of soil and under various conditions of climate. It yields the largest, quickest and most profitable returns under careful cultivation on good land in a moist climate.

Agave—General remarks.

41. Only one plantation (Dauracherra Fibre Company, Sylhet) has existed long enough to yield definite results and these do not prove that Agave cultivation in Assam is certain to be a profitable industry.

Agave in Assam.

42. A few plantations of Agave exist in the United Provinces, but have hardly reached the cutting stage. The raw material which is at present dealt with is chiefly obtained from railway fences taken on lease.

Agave in United Provinces.

43. The only place in the Madras Presidency where Agave fibre has been extracted on a commercial scale is in the Coimbatore district from the plants growing along the railway lines. This species proves to be Agave vera-cruz. Several European planters are trying Sisal in the planting districts, and the Madras Fibre Company has some plantations in the Anantpur and Chingleput Districts. The cultivation of Agave is not likely to be taken up in the near future by ordinary ryots. The extraction of the fibre by hand is unpleasant on account of skin irritation caused by the sap. The chief purpose of the Hindupur Government plantation is to grow Agave experimentally on land where the rainfall is too precarious for other crops. It is also intended to supply Sisal plants to those who are interested in the cultivation of this plant.

Agave in Madras.

44. Agave has been but little exploited in the Central Provinces, and the cultivation is not likely to become popular. The common species there is *Agave Cantala*. It is usually grown in hedges, around groves and gardens, but nowhere in abundance. Fibre is not extracted from it extensively. In the Kawardha Feudatory State adjoining Bilaspur, its cultivation is fairly large, and the fibre is used in making ropes and cloth. The labour involved in extracting the fibre is considered both hard and degrading, while the juice of leaves produces eczema on the legs and arms of the labourers. Agave cultivation has been extended of late at the jails in the Central Provinces, and the Inspector-General of Prisons had 87,459 aloes planted out last year in his various gardens. At these jails, all the work of cultivation, of extracting the fibre and of making it into ropes, rugs, etc., is done by the prisoners. This industry engages labour at all times of the year. On the *bhata* plains of Chhattisgarh where there are very large areas of waste land, it may be possible to start aloe plantations; but if this is to be done successfully, the work will have to be undertaken by an enterprising firm with sufficient capital and practical knowledge. It has yet to be proved that the aloe can be profitably grown for commercial purposes on such soils without irrigation. Experimental trials are being made.

Agave cultivation in the Central Provinces.

45. So far as is known, the Agave vera-cruz is the only Agave found in Burma. It is not systematically cultivated for its fibre, though it is used in some prisons for rope making. It is not yet certain whether Agave would repay cultivation, and in any case a better species that A. vera-cruz should be grown.

Agave cultivation in Burma.

46. The extraction of fibre from pine-apple is not likely to become an extensive enterprise in any part of India. Sansevieria has been repeatedly tried by planters in Assam, but without paying results. It is possible that fibre can be profitably obtained from the pine-apple in Southern India.

Fibre from Pine-apple and Sansevieria.

47. Flax as a fibre crop is not yet produced on a commercial scale in India. Extensive experiments are in progress in Bengal. These experiments were begun about four years ago. They will, when complete, probably indicate that fibre of good quality can be profitably produced from this crop in several parts of India. There are large areas under linseed in the different Provinces, and in some places where the conditions are specially favourable it may be possible to produce good fibre as well as seed. In other tracts the coarse stem of the country linseed may yield fibre which is inferior but still worth extracting. Experiments are, however, required to determine this, and also to show how such fibre can best be utilised.

The prospects of flax as a fibre crop in India.

48. Flax cultivation has no particular prospect of success in the United Provinces, except perhaps in a few favourable localities; and unless the growers can afford to stack their straw until clean water is available.

Flax in the United Provinces.

49. Except on the Dharwar Farm, the different varieties of imported flax have not yet been found suitable for cultivation in the Bombay Presidency.

Flax in Bombay.

50. Flax has so far not succeeded in Burma, but no very systematic experiments have yet been made.

Flax in Burma.

51. In the Punjab, 39,874 acres of linseed were sown in 1906-07, 14,669 acres being in the Kangra district and most of the balance in the sub-montane districts; but in 1907-08 only 29,348 acres were sown. The crop is grown for seed. It is thought that good material for fibre has been obtained from trials made with Russian linseed. But the difficulty lies in the retting, and this is being studied at Lyallpur. Experiments which were conducted many years ago were well reported on as regards the growth of tbe plant. The retting question was not then fully examined. The local variety of the Punjab is not suitable for fibre purposes, owing to its established babit of short and bushy growth.

Flax in the Punjab.

52. The Bengal Agricultural Department tried *Malachra capitata* at Cuttack, but gave it up as hopeless after two years' trial. Similarly, experiments conducted at the Rajsbahi Experiment Station in Eastern Bengal and Assam, indicated that its cultivation is not likely to be profitable. Experiments have not yet been made in other Provinces.

Malachra capitata.

53. The Committee believes that it is possible to extend largely and profitably in the immediate future, the cultivation of jute, Sann-hemp and *Hibiscus cannabinus*, and that later on, it is possible that a portion of the linseed grown over large areas in various parts of India, may be utilized for the production of fibre as well as seed. A considerable increase of Agave cultivation is possible in Assam and in tracts which have similar physical and climatic conditions. Successful Rhea cultivation must apparently be limited to a comparatively narrow zone where both climate and soil are particularly suitable. The Committee affirms that jute is a very paying crop and believes that it can usually be followed by a food crop in the same year.

General ideas.

The Committee lays great stress on so arranging the rotation of food and fibre crops that the encouragement of the latter shall not be at the expense of the former. From this point of view, those fibre crops, which occupy the ground for one season only, are preferable to those of a perennial nature.

The Committee believes that the demand for fibres is bound to increase, as they are essential for nearly all branches of trade, also that it is not likely that prices will fall so low as to render fibre cultivation in India unremunerative.

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